TECHNICAL SPECIFICATIONS

FOR

GOLDEN VALLEY RANCH

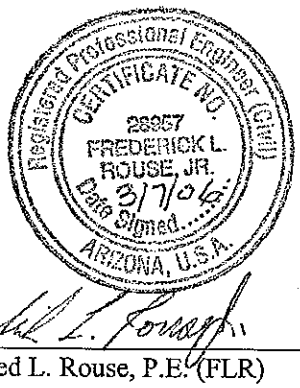
RESERVOIR 2750 N-1

April 12, 2006

Prepared by:

Stanley Consultants INC.
A Stanley Group Company
Engineering, Environmental and Construction Services - Worldwide

The following design professionals certify that the Drawings and Project Manual were prepared by them or under their direct supervision. Initials of each registered engineer appear in the Table of Contents following the title of each technical specification section for which each professional was responsible.



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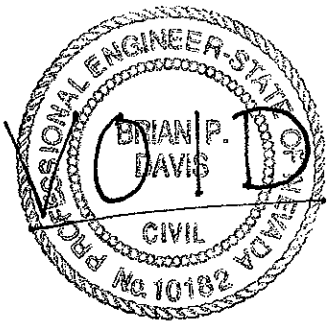

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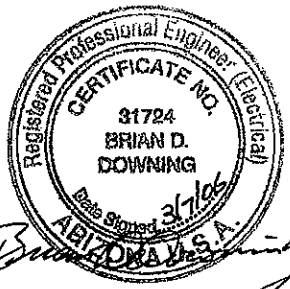

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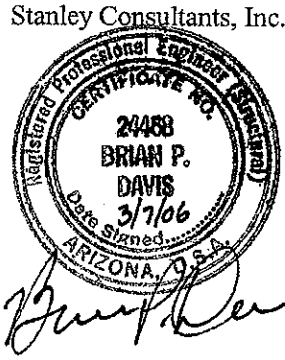

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SECTION 01110
SUMMARY OF WORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Description of Work.

B. CONTRACTOR'S use of Site.

C. Work sequence.

D. OWNER occupancy.

E. Storm water pollution prevention plan (SWPPP).

1.02 WORK COVERED BY CONTRACT DOCUMENTS

A. Work comprises construction of one 1,000,000-gallon, welded steel reservoir including the following:

1. Tank drain system.
2. Foundation work.
3. Floor.
4. Walls.
5. Center column and rafters.
6. Roof including vent.
7. Hatch with alarm, landing, ladders, etc.
8. Cathodic Protection
9. Painting/Coatings.
10. Instrumentation.
11. Chlorination and testing.

B. Work comprising the Site construction includes the following:

1. Site excavation, backfill and compaction.
2. Site piping, valves, etc.
3. Site electrical.
4. Masonry wall.

C. Project Site is located in Mohave County, Arizona.

D. The Work includes:

SECTION 01110
SUMMARY OF WORK

1. Furnishing of all labor, material, superintendence, power, light, heat, fuel, water, tools, appliances, equipment, supplies, services and other means of construction necessary or proper for performing and completing the work.
2. Sole responsibility for the adequacy of labor and equipment.
3. Maintaining the work area and site in a clean and acceptable manner.
4. Protection of finished and unfinished work.
5. Repair and restoration of work damaged during construction.
6. Furnishing, as necessary, proper equipment and machinery, of a sufficient capacity, to facilitate the work and to handle all emergencies normally encountered in work of this character.
7. Furnishing, installing, and protecting all necessary guides, tracks, rails, bearing plates, anchor and attachment bolts, and all other appurtenances needed for the installation of the devices included in the equipment specified. Make anchor bolts of appropriate size, strength and material for the purpose intended. Furnish substantial templates and shop drawings for installation.

1.03 CONTRACTOR'S USE OF SITE

A. Limit use of Site and premises for Work, storage, and to allow for:

1. Coordinating Work under this Contract with work of other contractors where Work under this Contract encroaches on work of other contractors.
2. Coordination of site use with ENGINEER and OWNER, and daily use patterns for parking, and roadway travel.
3. Responsibility for protection and safekeeping of products under this Contract.
4. Providing additional off-site storage at no additional cost to OWNER as needed.
5. Coordinating this section with all others sections as required in the General Conditions.

1.04 WORK SEQUENCE

A. Reservoir 2750 N-1 is the first reservoir being constructed. Construction of all future facilities shall be carried out so reservoir will be accessible and able to operate at all times.

1.05 OWNER OCCUPANCY

A. CONTRACTOR shall at all times conduct its operations as to ensure least inconvenience to general public.

1.06 STORM WATER POLLUTION PREVENTION PLAN (SWPPP)

A. The CONTRACTOR shall submit and implement the stipulations of a storm water pollution prevention plan (SWPPP).

SECTION 01110
SUMMARY OF WORK

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

- END OF SECTION -

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SECTION 01310
PROJECT MEETINGS

PART 1 GENERAL

1.01 PRECONSTRUCTION CONFERENCE

A. Prior to commencement of Work at Site, preconstruction conference will be held at mutually agreed time and place. Conference shall be attended by:

1. CONTRACTOR and its superintendent.
2. Principal Subcontractors.
3. ENGINEER.
4. Representatives of OWNER.
5. Governmental representatives as appropriate.
6. Others as requested by CONTRACTOR, OWNER, or ENGINEER.

B. Purpose of conference is to designate responsible personnel and establish working relationship. Matters requiring coordination will be discussed and procedures for handling such matters established. Agenda will include:

1. CONTRACTOR'S tentative schedules.
2. Transmittal, review, and distribution of CONTRACTOR'S submittals.
3. Processing applications for payment.
4. Maintaining record documents.
5. Critical Work sequencing.
6. Field decisions and Change Orders.
7. Use of premises, office and storage areas, security, housekeeping, and OWNER'S needs.
8. Major equipment deliveries and priorities.
9. CONTRACTOR'S assignments for safety and first aid.

C. OWNER will preside at preconstruction conference and will arrange for keeping minutes and distributing minutes to persons in attendance.

1.02 CONSTRUCTION PROGRESS MEETINGS

A. CONTRACTOR shall schedule and hold regular progress meetings at least bi-weekly and at other times as requested by the ENGINEER or as required by the progress of the Work.

B. CONTRACTOR, ENGINEER, and all Subcontractors active on the site shall be represented at each meeting.

C. OWNER and CITY shall be given at least 48 hours notice of meeting and may attend at their discretion.

D. Meetings shall be held at the job-site in the ENGINEER'S office.

SECTION 01310
PROJECT MEETINGS

E. CONTRACTOR shall preside at meetings.

F. CONTRACTOR shall prepare and distribute two week look ahead schedule.

G. ENGINEER will prepare and distribute meeting minutes.

H. The purpose of the meeting will be the following:

1. Review the progress of the Work.
2. Discuss upcoming Work activities.
3. Discuss changes in scheduling.
4. Resolve other problems that may arise.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

- END OF SECTION -

SECTION 01330
SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submittal procedures.

B. Construction progress schedules.

C. Welding certificates.

D. Field performance tests.

E. Shop Drawings.

F. Product Data.

G. Samples.

H. Engineer's duties.

1.02 SUBMITTAL PROCEDURES

A. Deliver submittals to:

Mr. Dennis Atwood, P.E.
Stanley Consultants, Inc.
5820 S. Eastern Avenue, Suite 200
Las Vegas, NV 89119

B. Transmit each item under Shop Drawing Transmittal Form, bound herein. Identify Project, CONTRACTOR, Subcontractor, and major supplier; identify pertinent Drawing sheet and detail number, and Specification section number, as appropriate. Identify deviations from Specifications. Provide space for CONTRACTOR and ENGINEER review stamps on each item. Shop Drawings will be submitted within the first 90 days after agreement is signed.

C. Submit initial progress schedules and schedule of values in duplicate within 15 days after award of contract. After review by ENGINEER revise and resubmit as required.

D. Comply with progress schedule for submittals related to Work progress. Coordinate submittal of related items.

E. Notify ENGINEER in writing, at time of submission, of any deviations in submittals from requirements of Contract Documents. Any such deviations permitted by ENGINEER will require modifications of Contract Documents.

F. Begin no fabrication or Work which requires submittals until return of submittals by ENGINEER with ENGINEER stamp, as either "No Exceptions Taken" or "Make Corrections Noted."

G. After ENGINEER review of submittal, revise and resubmit as required, identifying changes made since previous submittal.

H. Distribute reproductions of Shop Drawings which carry ENGINEER stamp as either "No Exceptions Taken" or "Make Corrections Noted" to:

1. Job site file.
2. Record documents file.
3. Other affected contractors.
4. Subcontractors.
5. Supplier or fabricator.
6. Two copies to OWNER (Quality Control).

I. Distribute Samples which carry ENGINEER stamp as either "No Exceptions Taken" or "Make Corrections Noted" as directed by ENGINEER.

1.03 CONSTRUCTION PROGRESS SCHEDULES

A. Submit horizontal bar chart with separate bar for each major trade or operation, identifying first work day of each week.

B. Show complete sequence of construction by activity, identifying work of separate stages and other logically grouped activities. Show projected percentage of completion for each item of Work as of time of each progress Application for Payment.

C. Show submittal dates required for Shop Drawings, Product Data, and Samples, and Product delivery dates, including those furnished by OWNER and those under Allowances.

1.04 WELDING CERTIFICATES

A. Promptly after Notice of Award, submit to ENGINEER one copy, unless specified otherwise, for each person, by name, assigned to do field welding of materials installed under this Agreement.

B. Show on certificates that each person has passed tests specified by AWS.

C. Submit certificates prior to execution of any welding. Certificates not required for nonstructural tack welding.

1.05 FIELD PERFORMANCE TESTS

A. After system or equipment necessary for operation of Work is in operating condition, CONTRACTOR shall supervise operation of equipment or system for period sufficient to assure proper functioning, and make necessary observations, investigations, and adjustment.

B. Notify OWNER when Work is considered to be complete, in operating condition, and ready for inspection and tests.

C. OWNER and CONTRACTOR will conduct tests it deems necessary to determine if equipment or system functions properly.

D. If equipment or system fails to function properly, CONTRACTOR shall make necessary corrections, including replacement, at no cost to OWNER, and after such corrections are completed, demonstrate to ENGINEER that equipment or system functions properly.

1.06 SHOP DRAWINGS

A. Shop Drawings shall be presented in clear and thorough manner, complete with respect to dimensions, design criteria, materials of construction, and like information to enable ENGINEER to review information as required. Details shall be identified by reference to sheet and detail, schedule or room numbers shown on Drawings.

B. Minimum sheet size: 8-1/2" x 11". All sheets larger shall be folded to 8-1/2" x 11".

C. Shop Drawings:

1. Submit one opaque reproducible copy of each Shop Drawing.
2. Shop Drawings not larger than 24" x 36", copies of Drawings submitted shall be black line on white background or reproducible mylars.
3. CONTRACTOR shall submit 8 copies of each Shop Drawing.

D. Reproducible copies of Shop Drawings, if requested herein:

1. Submit one "mylar," or equal, reproducible print. Vellum sepias or other nonpermanent reproducible prints are not acceptable.
2. Reproducible copies of Shop Drawings shall show "as built" conditions of equipment and shall show field modifications required during installation.
3. CONTRACTOR will provide marked up print of application Shop Drawings showing field modifications made during installation, within 5 days after it has sufficient information to prepare same.

E. Submittals shall contain:

1. Date of submission and dates of any previous submissions.
2. Project title and number.
3. Contract identification.
4. Names of:
   a. CONTRACTOR.
   b. Supplier.
   c. Manufacturer.
5. Identification of product, with Specification section number.
6. Field dimensions, clearly identified as such.
7. Relation to adjacent or critical features of Work or materials.

8. Applicable standards, such as ASTM or Federal Specification numbers.
9. Identification of deviations from Contract Documents.
10. Identification of revisions on resubmittals.
11. An 8" x 3' blank space for CONTRACTOR and ENGINEER stamps.
12. Indication of CONTRACTOR'S approval, initialed or signed, with wording substantially as follows:

    "CONTRACTOR represents to OWNER and ENGINEER that CONTRACTOR has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data, or assumes full responsibility for doing so and has reviewed or coordinated each Shop Drawing Sample with requirements of Work and Contract Documents."

F. Resubmission requirements: Make any corrections or changes in submittals required by ENGINEER and resubmit until stamped as either "No Exceptions Taken" or "Make Corrections Noted" by ENGINEER. Indicate any changes which have been made other than those requested by ENGINEER.

1.07 PRODUCT DATA

A. Mark each copy to identify applicable products, models, options, and other data; supplement manufacturers' standard data to provide information unique to Work. Include manufacturers' installation instructions when required by Specification section.

B. Submit the number of copies which CONTRACTOR requires, plus 2 copies which will be retained by ENGINEER.

1.08 SAMPLES

A. Submit full range of manufacturers' standard colors, textures, and patterns for ENGINEER'S selection. Submit samples for selection of finishes within 30 days after date of Contract.

B. Submit Samples to illustrate functional characteristics of product, with integral parts and attachment devices. Coordinate submittal of different categories for interfacing work.

C. Include identification on each Sample, giving full information.

D. Submit number specified in respective Specification section; one will be retained by ENGINEER. Samples which may be used in Work are indicated in Specification section.

E. Provide field finishes at Project as required by individual Specifications section. Install Sample complete and finished. Acceptable finishes in place may be retained in completed Work.

SECTION 01330
SUBMITTALS

1.09 ENGINEER DUTIES

A. Review required submittals with reasonable promptness and in accord with schedule, only for general conformance to design concept of Project and compliance with information given in Contract Documents. Review shall not extend to means, methods, sequences, techniques, or procedures of construction or to safety precautions or program incident thereto. Review of a separate item as such will not indicate approval of assembly in which item functions.

B. Affix stamp and initials or signature, and indicate requirements for resubmittal, or review of submittal. ENGINEER'S action on submittals is classified as follows:

1. **No Exception Taken**: Submittal has been reviewed and appears to be in conformance to design concept of Project and Contract Documents. CONTRACTOR may proceed with fabrication of work in submittal.

2. **Make Corrections Noted**: Submittal has been reviewed and appears to be in conformance to design concept of Project and Contract Documents, except as noted by ENGINEER. CONTRACTOR may proceed with fabrication of work in submittal with modifications and corrections as indicated by ENGINEER.

3. **Amend-Resubmit**: Submittal has been reviewed and appears not to be in conformance to design concept of Project or with Contract Documents. CONTRACTOR shall not proceed with fabrication of work in submittal, but instead shall make any corrections required by ENGINEER and resubmit for review.

4. **Rejected-Resubmit**: Submittal has been reviewed and appears not to be in conformance to design concept of Project or with Contract documents. CONTRACTOR shall not proceed with fabrication of work in submittal, but instead shall make any corrections required by ENGINEER and resubmit for review.

C. Return submittals to CONTRACTOR.

D. ENGINEER'S review of submittals shall not relieve CONTRACTOR from responsibility for any deviations from Contract Documents unless CONTRACTOR has, in writing, called ENGINEER'S attention to such deviation at time of submission, and ENGINEER has given written concurrence pursuant to Contract Documents to specific deviation, nor shall any concurrence by ENGINEER relieve CONTRACTOR from responsibility for errors or omissions in submittals. Corrections indicated on submittals shall be considered as changes necessary to meet the requirements of the Contract Documents and shall not be taken as the basis of claims for extra work.

- END OF SECTION -

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SECTION 01400
QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Quality control.

B. Workmanship.

C. Manufacturer's instructions.

D. Manufacturer's certificates.

E. Testing laboratory services.

1.02 RELATED REQUIREMENTS

A. Conditions of Agreement: Inspection and testing required by OWNER and governing authorities.

B. Section 01330 - Submittals: Submittal of manufacturers' instructions.

C. Section 03300 – Cast-in-Place Concrete: Tests required for concrete.

1.03 QUALITY CONTROL, GENERAL

A. Maintain quality control over suppliers, manufacturers, products, services, Site conditions, and workmanship, to produce Work of specified quality.

1.04 WORKMANSHIP

A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.

B. Perform Work by persons qualified to produce workmanship of specified quality.

C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking.

1.05 MANUFACTURERS' INSTRUCTIONS

A. Comply with instructions in full detail, including each step in sequence. Should instructions conflict with Contract Documents, request clarification from ENGINEER before proceeding.

1.06 MANUFACTURERS' CERTIFICATES

A. When required by individual Specifications section, submit manufacturer's certificate, in duplicate, that products meet or exceed specified requirements.

SECTION 01400
QUALITY REQUIREMENTS

1.07 TESTING LABORATORY SERVICES

A. CONTRACTOR shall employ and pay for services of independent testing laboratory to perform inspections, tests, and other services required by various Specification sections.

1. Prior to start of Work, submit testing laboratory name, address, and telephone number, and names of full time registered ENGINEER and responsible officer.

2. Submit copy of report of laboratory facilities inspection made by Materials Reference Laboratory of National Bureau of Standards during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.

B. The independent firm will perform tests, inspections and other services specified in individual specification sections and as required by the Authority having jurisdiction.

1. Laboratory: Authorized to operate in location in which Project is located.

2. Laboratory Staff: Maintain a full time registered ENGINEER on staff to review services.

3. Testing Equipment: Calibrated at reasonable intervals with devices of an accuracy traceable to either National Bureau of Standards or accepted values of natural physical constants.

C. Testing, inspections and source quality control may occur on or off the project site. Perform off site testing as required by the CONTRACTOR or ENGINEER.

D. Reports will be submitted by the independent firm to the ENGINEER and CONTRACTOR, in duplicate, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.

E. Cooperate with independent firm; furnish samples of materials, design mix, equipment, tools, storage, safe access, and assistance by incidental labor as requested.

1. Notify ENGINEER and independent firm 24 hours prior to expected time for operations requiring services.

2. Make arrangements with independent firm and pay for additional samples and tests required for CONTRACTOR'S use.

F. Testing and employment of testing agency or laboratory shall not relieve CONTRACTOR of obligation to perform Work in accordance with requirements of Contract Documents.

G. Re-testing or re-inspection required because of non-conformance to specified requirements shall be performed by the same independent firm on instructions by the ENGINEER at no additional cost to the OWNER.

H. Agency Responsibilities:

1. Test samples of mixes submitted by CONTRACTOR.

2. Provide qualified personnel at site. Cooperate with ENGINEER and CONTRACTOR in performance of services.

3. Perform specified sampling and testing of products in accordance with specified standards.

4. Ascertain compliance of materials and mixes with requirements of Contract Documents.

5. Promptly notify ENGINEER and CONTRACTOR of observed irregularities or non-conformance of Work or products.
6. Perform additional tests required by ENGINEER.
7. Attend preconstruction meetings and construction progress meetings.

I. Agency Reports: After each test, promptly submit two copies of report to ENGINEER and CONTRACTOR. When requested by ENGINEER, provide interpretation of test results. Include the following:

1. Date issued.
2. Project title and number.
3. Name of inspector.
4. Date and time of sampling or inspection.
5. Identification of product and specifications section.
6. Location in the Project.
7. Type of inspection or test.
8. Date of test.
9. Results of tests.
10. Conformance with Contract Documents.

J. Limits On Testing Authority:

1. Agency or laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.
2. Agency or laboratory may not approve or accept any portion of the Work.
3. Agency or laboratory may not assume any duties of CONTRACTOR.
4. Agency or laboratory has no authority to stop the Work.

1.08 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment as applicable, and to initiate instructions when necessary.

B. Submit qualifications of observer to ENGINEER 30 days in advance of required observations. Observer subject to approval of ENGINEER.

C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

SECTION 01400
QUALITY REQUIREMENTS

1.09 REFERENCES

A. For products or workmanship specified by association, trade, or other consensus standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard by date of issue current as of Bid Date, except where a specific date is established by code.

C. Obtain copies of standards where required by product specification sections.

D. Should specified reference standards conflict with Contract Documents, request clarification from the ENGINEER before proceeding.

E. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of the ENGINEER shall be altered from the Contract Documents by mention or inference otherwise in any reference document.

F. Abbreviations used in Drawings and Specifications are as specified in ANSI Y1.1 and IEEE 260.

G. Schedule of references:

1. ACI - American Concrete Institute
2. AI - Asphalt Institute
3. AISC - American Institute of Steel Construction
4. AISI - American Iron and Steel Institute
5. ANSI - American National Standards Institute
6. ARI - Air-Conditioning and Refrigeration Institute
7. ASCE - American Society of Civil Engineers
8. ASME - American Society of Mechanical Engineers
9. AWS - American Welding Society
10. AWWA - American Water Works Association
11. CLFMI - Chain Link Fence Manufacturers Institute
12. EPA - Environmental Protection Agency
13. HI - Hydraulics Institute
14. IEEE - Institute of Electrical and Electronics Engineers
15. ISA - The Instrumentation, Systems, and Automation Society
16. ISO - International Standards Organization
17. NACE - NACE International
18. NSF - NSF International
19. OSHA - U. S. Department of Labor, Occupational Safety and Health Administration

20. PCA - Portland Cement Association
21. PCI - Precast/Prestressed Concrete Institute
22. PS - Product Standard
23. SSPC - The Society for Protective Coatings
24. STI - Steel Tank Institute
25. UL - Underwriters' Laboratories, Inc.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that existing Site conditions and substrate surfaces are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new Work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Verify that utility services are available, of the correct characteristics, and in the correct locations.

3.02 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate.

3.03 FIELD PERFORMANCE TESTS

A. After system or equipment necessary for operation of Work is in operating condition, CONTRACTOR shall supervise operation of equipment or system for period sufficient to assure proper functioning, and make necessary observations, investigations, and adjustments.

B. Notify ENGINEER when Work is considered to be complete, in operating condition, and ready for inspection and tests.

C. ENGINEER will conduct tests it deems necessary to determine if equipment or system functions properly.

D. If equipment or system fails to function properly, or guaranteed performance is not indicated, CONTRACTOR shall make necessary corrections, including replacement, at no cost to OWNER,

and after such corrections are completed, demonstrate to ENGINEER that equipment or system functions properly and guaranteed performance is obtainable.

- END OF SECTION -

SECTION 01500
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary utilities:
   1. Temporary electricity.
   2. Temporary heating and ventilation.
   3. Telephone service.
   4. Temporary water service.
   5. Temporary sanitary facilities.

B. Construction facilities:
   1. Special tools.
   2. Explosives and blasting.
   3. Sheds.

C. Temporary controls:
   1. Barriers.
   2. Protection of the Work.
   3. Debris control.
   4. Pollution control.

D. Removal of utilities, facilities, and controls.

1.02 ELECTRICITY, LIGHTING

A. Provide temporary construction power, wiring and lighting as required during construction.

B. Illumination levels: In accordance with OSHA requirements for construction lighting.

C. Equipment and materials need not be new.

D. Temporary wiring shall be sized and fused in accordance with NEC requirements.

1.03 HEAT, VENTILATION

A. Provide as required to maintain specified conditions for construction operations, to protect materials and finishes from damage due to temperature or humidity.

B. Prior to operation of permanent facilities for temporary purposes, verify that installation is approved for operation, and that filters are in place.

C. Provide ventilation of enclosed areas to cure materials, to disperse humidity, and to prevent accumulations of dust, fumes, vapors, or gases.

1.04 TELEPHONE SERVICE

A. Provide telephone service to the field office or cellular phone service and number for field superintendent.

1.05 WATER

A. All water required for and in connection with the Work to be performed shall be furnished by and at the expense of the CONTRACTOR.

B. CONTRACTOR solely responsible for obtaining all applicable permits and paying all fees associated with obtaining water.

C. CONTRACTOR shall provide all necessary tools, hose, and pipe, or otherwise transport the water to the point of use, and shall make its own arrangements as to the amount of water required and the time when the water will be needed.

1.06 SANITARY FACILITIES

A. CONTRACTOR shall furnish temporary sanitary facilities at the Site, as provided herein, for the needs of all construction workers and others performing work or furnishing services.

1. Sanitary facilities shall be of reasonable capacity, properly maintained throughout the construction period.

2. If toilets of the chemically treated type are used, at least one toilet shall be furnished for each 20 persons.

1.07 SPECIAL TOOLS

A. Provide special tools necessary.

1.08 BARRIERS

A. Provide as required to prevent public entry to construction areas and to protect existing facilities and adjacent properties from damage from construction operations.

B. Provide barricades as required by governing authorities for rights of way and for access to existing facilities.

1.09 PROTECTION OF INSTALLED WORK

A. Provide temporary protection for installed products. Control traffic in immediate area to minimize damage.

B. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings. Protect finished floors from traffic, movement of heavy objects, and storage.

C. Prohibit traffic and storage on waterproofed and roofed surfaces.

1.10 DEBRIS CONTROL

A. Keep areas free from extraneous debris; keep work area in neat, clean, and safe condition.

B. Initiate and maintain specific program to prevent accumulation of debris at site, in storage and parking areas, and along access roads and haul routes, as follows:

1. Provide containers for deposit of debris.
2. Prohibit overloading of trucks to prevent spillage on access and haul routes.
3. Perform periodic inspections to enforce these requirements.

C. Schedule periodic collection and disposal of debris and provide additional collection and disposal of debris whenever periodic schedule is inadequate to prevent accumulation.

D. If CONTRACTOR fails to clean up as provided in Contract Documents, OWNER may do so and cost thereof will be charged to CONTRACTOR.

1.11 POLLUTION CONTROL

A. Prevent contamination of soil, water, or atmosphere by discharge of noxious substances from construction operations, including equipment, personnel and emergency measures required to contain any spillage, and to remove contaminated soils or liquids.

B. After obtaining proper approvals, excavate and dispose of contaminated earth off site, and replace with suitable compacted fill.

C. Take special precautions to prevent harmful substances from entering public waters.

D. Prevent disposal of wastes, effluents, chemicals or other substances adjacent to washes, or in sanitary or storm sewers.

E. Control atmospheric pollutants to prevent toxic concentrations of chemicals, and to prevent harmful dispersal of pollutants into atmosphere.

F. Project is located in Mohave County, Arizona.

1. Contact Arizona Department of Environmental Quality (Air Pollution Control Division) regarding special considerations concerning air quality requirements in the State.
2. Compliance with rules, regulations, special stipulations and laws pertaining to air quality shall be Contractor's responsibility and cost thereof shall be considered in Contract lump sum price.

1.12 EXPLOSIVES AND BLASTING

A. Use of explosives on Work will not be permitted without written approval of OWNER pursuant to review of CONTRACTOR supplied blasting program.

1.13 CLEANING DURING CONSTRUCTION

A. Control accumulation of waste materials and rubbish; periodically dispose of off-site.

B. Clean interior areas prior to start of finish Work, maintain areas free of dust and other contaminants during finishing operations.

1.14 SHEDS

A. Storage sheds for tools, materials, and equipment: Weathertight with adequate space for organized storage and access, and lighting for inspection of stored materials.

1.15 REMOVAL

A. Remove temporary materials, equipment, services, and construction prior to Substantial Completion inspection.

B. Clean and repair damage caused by installation or use of temporary facilities.

C. Restore existing facilities used during construction to original condition.

1.16 SITE SECURITY

A. The Site shall remain secure at all times.

B. The CONTRACTOR shall be solely responsible for keeping it's equipment and materials secure. Temporary fencing may be constructed at CONTRACTOR'S option and expense.

C. The CONTRACTOR shall have an established program or policy for performing employee background checks and shall perform these checks for all employees working on this Project. Any employees deemed a security risk shall immediately be removed from the Site by the CONTRACTOR.

D. The CONTRACTOR shall identify a single person (Security Coordinator) in charge of site security and provide a name and 24-hour access number. This individual shall be responsible for coordinating all security activities and making sure all security requirements are met.

E. CONTRACTOR shall submit a list of employees that will work onsite prior to beginning any Work. The list shall be updated and resubmitted when any changes are made to the CONTRACTOR'S work force.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

- END OF SECTION -

SECTION 01530
PROTECTION OF EXISTING FACILITIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Protect existing utilities and improvements not designated for removal.

B. Restore damaged or temporarily relocated utilities and improvements to condition equal to or better than they were prior to such damage or temporary relocation.

C. Verify exact locations and depths of utilities shown and make exploratory excavations of utilities that may interfere with Work.

1. Perform exploratory excavations as soon as practicable after award of Contract and in sufficient time in advance of construction to avoid possible delays to Work.

2. When exploratory excavations show utility location as shown to be in error, notify ENGINEER.

D. Number of exploratory excavations required shall be sufficient to determine alignment and grade of existing utilities.

1.02 RIGHTS OF WAY

A. Access to lands or rights of way, for Work will be provided by OWNER.

1. Nothing contained in Contract Documents shall be interpreted as giving CONTRACTOR exclusive occupancy of lands or rights of way provided.

2. Additional lands or rights of way required for construction operations shall be provided by CONTRACTOR at his own expense, but only approved and conditioned by the OWNER.

B. Do not enter nor occupy with men, equipment, or materials, lands outside rights of way or easements shown.

1.03 PROTECTION OF STREET OR ROADWAY MARKERS

A. Do not destroy, remove, or otherwise disturb existing survey markers or other existing street or roadway markers without proper authorization.

B. Start no excavation until survey or other permanent marker points that will be disturbed by construction operations have been properly referenced for easy and accurate restoration. Restoration will be by the OWNER.

C. Notify OWNER of time and location that work will be done, 1 week in advance of construction to avoid delay due to waiting for survey points to be satisfactorily referenced for restoration.

D. Survey markers or points disturbed by CONTRACTOR without proper authorization by OWNER will be restored by OWNER at CONTRACTOR'S expense.

SECTION 01530
PROTECTION OF EXISTING FACILITIES

1.04 CONSTRUCTION INTERFERENCES

A. CONTRACTOR'S responsibilities regarding existing utilities and construction interferences shall be in accordance with Subsection 105.06 of Uniform Standard Specifications for Public Works' Construction, Clark County Area, Nevada.

B. Construction interferences include:

1. Utility or service connections within limits of excavation or over excavation required for Work.

2. Utility or service connections located in space which will be required by Work.

3. Utility or service connections required to be disturbed or removed to permit construction as specified under Contract.

C. Disturb or remove connections only with approval of OWNER and following notification to OWNER of interfering utility or service connection.

D. Promptly reconstruct utility or service connections removed or otherwise disturbed in original or other authorized location in condition at least as good as prior to such removal or disturbance, subject to inspection of utilities' owners.

E. CONTRACTOR'S responsibility to remove or replace shall apply even if damage or destruction occurs after backfilling.

F. Immediately notify owner of utility or service connection damage, or if destruction occurs or is discovered.

G. During performance of Work, owner of utility affected by Work shall have right to enter when necessary upon any portion of Work for purpose of maintaining service and of making changes in or repairs to utility.

H. CONTRACTOR shall submit plans for approval of relocation, repair or replacement of utilities to the agency having jurisdiction over utility or service connection to authorize or otherwise provide for its removal, relocation, protection, support, repair, maintenance, or replacement.

I. Exercise extreme care not to damage existing utilities and/or new and existing facilities which do not physically constitute construction interference. CONTRACTOR shall be responsible for costs of repair and/or replacement of new or existing facilities damaged by construction operations, as determined by OWNER.

J. Contact "CALL BEFORE YOU DIG" not less than 48 hours prior to starting any excavation. Notify by telephone and comply with instructions received; toll free number is 1-800-227-2600.

1. Utility companies may not be members of USA System and, therefore, not automatically contacted by above referenced telephone number.

2. CONTRACTOR shall be responsible for making himself aware of utility company facilities not reported by USA System, and shall bear damages stemming from repair or delay costs or other expenses resulting from unanticipated discovery of underground utilities.

3. Notify the following utilities at least 2 working days in advance of commencement of Work at site, to examine construction site and mark location of utilities' respective facilities. Verify that each utility has responsibly responded to notification.
4. If above telephone numbers are changed, CONTRACTOR is not relieved of responsibility for notifying various utilities.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

- END OF SECTION -

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SECTION 01600
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 PRODUCTS

A. Products include material, equipment, and systems.

B. Comply with Specifications and referenced standards as minimum requirements.

C. Components required to be supplied in quantity within a Specification Section shall be the same, and shall be interchangeable.

1.02 TRANSPORTATION AND HANDLING

A. Transport products by methods to avoid product damage; deliver in undamaged condition in manufacturer's unopened containers or packaging, dry.

B. Provide equipment and personnel to handle products by methods to prevent soiling or damage.

C. Promptly inspect shipments to assure that products comply with requirements, quantities are correct, and products are undamaged.

D. ENGINEER shall be allowed to inspect all products upon delivery without CONTRACTOR approval.

1.03 STORAGE AND PROTECTION

A. Store products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store sensitive products in weathertight enclosures; maintain within temperature and humidity ranges required by manufacturer's instructions.

B. For exterior storage of fabricated products, place on sloped supports above ground. Cover products subject to deterioration with impervious sheet covering; provide ventilation to avoid condensation.

C. Store loose granular materials on solid surfaces in a well-drained area; prevent mixing with foreign matter.

D. Arrange storage to provide access for inspection. Periodically inspect to assure products are undamaged, and are maintained under required conditions.

1.04 PRODUCT OPTIONS

A. Products specified by reference standards or by description only: Any product meeting those standards.

B. Products specified by naming one or more manufacturers with a provision for substitutions: Submit a request for substitution for any manufacturer not specifically named. Substitution will be allowed only if approved by the ENGINEER and OWNER.

C. Products specified by naming several manufacturers: Products of named manufacturers meeting Specifications; no options, no substitutions allowed.

D. Products specified by naming only one manufacturer: No options, no substitutions allowed.

1.05 PRODUCTS LIST

A. Within 30 days after Notice of Award, submit complete list of major equipment proposed for use, with name of manufacturer, trade name, and model number of each product.

1.06 SUBSTITUTIONS

A. Any substitutions will require approval by the City prior to consideration by the OWNER and ENGINEER.

B. Only within 30 days after effective date of Contract will ENGINEER consider requests from CONTRACTOR for substitutions. Subsequently, substitutions will be considered only when product becomes unavailable due to no fault of CONTRACTOR.

C. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.

D. Request constitutes a representation that CONTRACTOR:

1. Has investigated proposed product and determined that it meets or exceeds, in all respects, specified product.
2. Will provide same warranty for substitution as for specified product.
3. Will coordinate installation and make other changes which may be required for Work to be complete in all respects.
4. Waives claims for additional costs which may subsequently become apparent.

E. Substitutions will not be considered when they are indicated or implied on Shop Drawings or product data submittals without separate written request, or when acceptance will require substantial revision of Contract Documents.

F. ENGINEER will determine acceptability of proposed substitution, and will notify CONTRACTOR of acceptance or rejection in writing within reasonable time.

G. Only one request for substitution will be considered for each product. When substitution is not accepted, provide specified product.

H. The CONTRACTOR or any SUBCONTRACTOR or Product representative shall not supply equipment that does not meet the technical criteria as defined herein and shall not make assumptions based on company, personal or other experience that differ from the design parameter defined for each component or system. Equipment that has been submitted based on assumptions as described above shall be rejected by the ENGINEER or OWNER's representative and shall be the responsibility of the CONTRACTOR (solely) to supply a product that meets the Technical Design and Specification requirements.

SECTION 01600
PRODUCT REQUIREMENTS

1.07 INSTALLATION, INSTRUCTIONAL, START-UP AND POST START-UP

A. General

1. Supply on-site services of manufacturers' representatives during construction, installation of the equipment, equipment start-up, and training of OWNER'S personnel for equipment operation.

2. Include and pay all costs for suppliers' and manufacturers' services, including, but not limited to, those specified.

B. Installation Service

1. Provide competent and experienced technical representatives of manufacturers of all equipment and systems as necessary to resolve assembly or installation procedures which are attributable to, or associated with, equipment furnished.

2. After equipment is installed, have representatives perform initial equipment and system adjustment and calibration to equipment conforming to specifications and manufacturer's requirements and instructions.

3. Provide ENGINEER with two copies of following for approval two (2) working days prior to training:

a. "Certificate of Installation Services" by manufacturers' representatives for each piece of equipment installed in the work, verifying:

1) That equipment is installed per manufacturers' directions and the Contract Documents.

2) That equipment is tested and is functioning as intended.

3) That nothing in installation voids any warranty.

4) That equipment, as installed, is ready to be operated by others.

5) That the equipment will perform the function for which it is installed "Merchantability."

b. Detailed report by manufacturers' representatives, for review of ENGINEER of the installation services performed, including:

1) Description of calibration and adjustments if made; if not in Operation and Maintenance Manuals, attach copy.

2) Description of any parts replaced and why replaced.

3) Type, brand name, and quantity of lubrication used, if any.

4) Description of problems encountered, and corrective action taken.

5) Any special instructions left with CONTRACTOR or ENGINEER.

4. The start-up of equipment will impact the operation of the OWNER's existing system (s). Therefore, obtain ENGINEER's approval in writing at least twenty-four hours prior to start-up of equipment. Reconfirm start-up confirmation with OWNER's operators prior to start-up. See Section 01330 for submittal processing time frames.

C. Instructional Services

1. Training is required for all equipment and systems. Provide competent and experienced technical manufacturer's representative to give detailed instructions to City of Yuma personnel for operation and maintenance of equipment. Include prestart-up and equipment start-up, classroom, and hands-on on-site equipment instruction.

2. Coordinate prestart-up training periods with ENGINEER and manufacturer's representatives.

   a. Do not begin prestart-up training earlier than 30 days prior to start-up.

   b. Notify ENGINEER at least 21 days before training sessions are to begin so ENGINEER can schedule training time with City of Yuma Water operating personnel. Reconfirm training dates with ENGINEER 2 weeks prior to actual training.

   c. Reschedule canceled training sessions as described above.

3. Provide equal service time for similar types of equipment differing in model, size or manufacturer.

4. Utilize Operating and Maintenance Manual as basis of instruction.

   a. Three final sets of technical operations manuals shall be supplied for the OWNER as a condition of acceptance of the project. Each set shall consist of one or more volumes, each of which shall be bound in a standard size, 3-ring, loose-leaf, vinyl plastic, hard cover binder suitable for bookshelf storage. Binder ring size shall not exceed three (3) inches.

   b. Initially, two (2) sets of these manuals shall be submitted to the ENGINEER for review after return of favorably reviewed shop drawings and date required herein. Following the ENGINEER's review, one set will be returned to the CONTRACTOR with comments. The manuals shall be revised and/or amended as required and the requisite final sets shall be submitted to the ENGINEER 15 days prior to start-up of systems. The ENGINEER will distribute the copies.

   c. Each operations manual shall include but not be limited to:

      1) Description of operations.

      2) Wiring diagrams and schematic drawings for all components, systems and the complete facility.

      3) One (1) original of the manufacturer's literature for all instruments, systems and equipment.

      4) A copy of the approved shop drawings.

      5) A trouble shooting guide.

      6) Manufacturer's instruction manuals for all instruments, systems and equipment.

      7) Manufacturer's provided O & M manuals are required on all mechanically or electrically operated devices, all electrical equipment and all instrumentation equipment.

      8) Calibration data sheets.

      9) Preventative maintenance plan and list.

d. Review contents of manual with personnel in full detail to explain all aspects of operations and maintenance.

5. Complete prestart-up training by manufacturer's representatives 14 days prior to actual plant start-up. During the 14 day period, provide to ENGINEER the following:

   a. Twenty-four hours per day of safe access to well site, structures and equipment.

   b. Proper identification of equipment not available for training. Notify ENGINEER of equipment not available for training.

   c. Electric, hydraulic or pneumatic power and equipment for use in hands-on training in the operation and maintenance of the equipment at no additional cost to the OWNER.

6. Provide "Certificate of Instructional Services" signed by ENGINEER and equipment representative, verifying that training has been accomplished to satisfaction of all parties. Use form provided in this section, and furnish ENGINEER with two copies.

7. Training provided by manufacturer's representative does not constitute substantial completion.

8. Use of equipment for training shall not void manufacturer's or contract warranties.

D. Start-up Services

1. CONTRACTOR shall provide five consecutive work days of reliability testing (pre-demonstration period) of all systems with the assistance of the manufacturer's representatives to perform a sequenced facility review.

2. Following the reliability testing CONTRACTOR shall provide 30 day commissioning and startup testing period, 24 hours per day continuous. During this period, the CONTRACTOR will operate the plant.

   a. Provide a start-up and operation of each component of the system and of the complete systems with manual and automatic mode of operation.

   b. Demonstrate restart-up of equipment system in the manual and automatic mode of operation (when applicable) following a simulated power outage.

   c. ENGINEER's representatives shall be invited to attend the start-up service and shall be provided an agenda of activities/services to be performed at least two (2) working days prior to the start-up date.

3. Contact ENGINEER for coordination and scheduling start-up services 2 weeks prior to proposed date of start-up.

4. Provide "Certificate of Start-up Service" cosigned by ENGINEER, City of Yuma Department of Public Works, CONTRACTOR and Equipment Manufacturer's Representatives, verifying that this service has been performed to all parties' expectations. Use form provided. Equipment representatives may sign individually under the comments portion provided on the form.

5. The start-up service is intended to fully demonstrate the system operation as a complete system. All components must be certified on Form 01600-1, attached at the end of this section, before start-up.

6. No work shall be deemed substantially complete until the start-up services have been successfully performed without incident and signed off on the form provided by all parties identified.

E. Post Start-up Services

1. Provide the services of an authorized service representative for each manufacturer to make a final inspection after the equipment of system has been in operation for at least 1 year.
2. ENGINEER may request, in writing, additional training by manufacturer's representative to be scheduled during final inspection of equipment.
3. Provide "Certificate of Post Start-up Service" cosigned by ENGINEER, City of Yuma Department of Public Works and equipment representative, verifying that this service has been performed. Use form provided in this section, and furnish ENGINEER with two copies.

F. Exercising of Equipment

1. Coordinate with City of Yuma to alternate operation of vertical turbine pumps and appurtenances for the first month of operation. Begin warranty period after first month of operation has been successfully completed. The operation test to be accomplished following start-up services successful completion.
2. If the operational test has been started and fails before completion of test period, replace or repair equipment. Retest entire system for the full 30 day test period. Conduct test on those systems which require load produced by weather (heating or cooling); exercise only when weather will produce proper load. Schedule test period with ENGINEER.
3. Tests shall be witnessed and approved by the ENGINEER. Provide fuel, power and other incidentals for all testing at no additional cost to the OWNER.
4. Tests shall not begin without written approval to begin test by the ENGINEER.

1.08 SPECIAL TOOLS AND LUBRICATING EQUIPMENT

A. General: Furnish, per manufacturer's recommendations, special tools required for checking, testing, parts replacement, and maintenance. (Special tools are those which have been specially designed or adapted for use on parts of the equipment, and which are not customarily and routinely carried by maintenance mechanics) including valve keys and stems.

B. Time of Delivery: Deliver special tools and lubricating equipment to OWNER when unit is placed into operation and after operating personnel have been properly instructed in operation, repair, and maintenance of equipment.

C. Quality: Provide tools and lubricating equipment of a quality compatible to equipment manufacturer has furnished.

1.09 LUBRICATION

A. General: Where lubrication is required for proper operation of equipment, incorporate in the equipment the necessary and prior provisions in accordance with manufacturer's requirements. Where possible, make lubrication automated and positive.

B. Oil Reservoirs: Where oil is used, supply reservoir of sufficient capacity to lubricate unit for a 24-hour period.

1.10 PERSONNEL TRAINING

A. The CONTRACTOR shall provide for classroom and hands-on training during regular working hours on weekdays for the OWNER's supervisory and operating personnel. Training shall be conducted by knowledgeable, competent personnel who are thoroughly familiar with the theory, design, operation and maintenance of the equipment.

B. The equipment for which training is to be given and the minimum number of hours of training is specified below:

Equipment Name	Minimum Hours	Post Startup Services Minimum Hours
Vertical Turbine Pumps	8	4
Motorized Butterfly Valves	4	2
Instrumentation	8	3
Electrical Equipment	8	3
Electrical Panels and Miscellaneous Control Equipment	8	4

Note: Training shall be coordinated with equipment list provided in this section.

C. The minimum hours listed are for actual classroom time, excluding additional time required for preparation and lag-time between sessions.

D. The OWNER's operating personnel shall be thoroughly trained to perform all operations covered in the instruction manuals, including the assembly and disassembly of all equipment items. The CONTRACTOR shall submit for approval a detailed outline of the proposed training schedule indicating how the training will be conducted, what subjects will be covered, and estimated dates for the start and completion of each phase of training.

E. The CONTRACTOR shall include the cost of training in the contract price and no separate payment will be made therefor. Salaries, fringe benefits, payroll taxes, and unemployment compensation costs for OWNER's personnel will be borne by the OWNER. Training costs shall be prorated amount the appropriate specifications sections in the CONTRACTOR's bid breakdown.

F. The OWNER may videotape the training sessions. If video taping is performed, the CONTRACTOR shall make all provisions necessary to accommodate the taping process at no additional cost.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

SECTION 01600
PRODUCT REQUIREMENTS

EQUIPMENT LIST

	Description	Forms (Section 01600)			
		01600-1	01600-2	01600-3	01600-4
1.	Vertical Turbine Pumps	X	X	X	X
2.	Valves	X	X	X	X
3.	Motors (all types)	X	X	X	X
4.	Electrical Panels and Disconnects	X	X	X	X
5.	Hangers, Couplings & Fittings	X	X		
6.	All Sensors, Level Controls, Transmitters & Probes	X	X	X	X
7.	Instrumentation and Controls	X	X	X	X
8.	All Electrical Equipment	X	X	X	X

Notes:

1. Contractor shall submit a complete inventory of all equipment to be provided as part of this list for Engineer's review.

2. Inventory to be submitted no later than 60 days following contract award.

3. The Contractor and all equipment representatives are responsible for updating this list to reflect detail design and equipment/system components shown as part of each shop drawing package.

4. The Contractor shall be responsible for coordinating all instructional/training requirements as defined as part of the equipment list. The minimum hours to be provided for training shall be 4 hours unless otherwise noted. (Reference Sections 01700, 01400, Division 11, 15, 16).

SECTION 01600
PRODUCT REQUIREMENTS

CERTIFICATE OF EQUIPMENT INSTALLATION SERVICES

Project _____

Equipment (Individual Component) _____

Specification Section _____

Contract _____

I hereby certify that the named equipment has been inspected by the Manufacturer's Representative and further certifies:

1. That the equipment is properly installed and is in accordance with the Contract Documents.

2. That equipment is tested and is functioning as intended.

3. That nothing in the installation shall void warranty.

3. That equipment, as installed, is ready to be operated by others.

MANUFACTURER'S REPRESENTATIVE

Signature _____ Date _____

Name (print) _____

Title _____

Representing _____

CONTRACTOR

Signature _____ Date _____

Name (print) _____

Title _____

Complete and submit three copies of this form with the detailed report to ENGINEER 24 hours prior to training of OWNER's personnel.

SECTION 01600
PRODUCT REQUIREMENTS

FORM 01600-1

SECTION 01600
PRODUCT REQUIREMENTS

CERTIFICATE OF INSTRUCTIONAL SERVICES

Project _____

Equipment _____

Specification Section _____

Contract _____

I hereby verify the equipment Manufacturers' Representative has instructed City of Yuma Department of Public Works personnel in start-up operation and maintenance of this piece of equipment as required in Contract Documents.

MANUFACTURER'S REPRESENTATIVE

Signature _____ Date _____

Name (print) _____

Title _____

Representing _____

CONTRACTOR

Signature _____ Date _____

Name (print) _____

Title _____

ENGINEER

Signature _____ Date _____

Name (print) _____

Title _____

MOHAVE COUNTY, DEPARTMENT OF PUBLIC WORKS

Signature _____ Date _____

Name (print) _____

Title _____

COMMENTS: _____

Complete and submit three copies of this form to ENGINEER upon completion of training. Training includes classroom, site and other training deemed necessary by City of Yuma.

SECTION 01600
PRODUCT REQUIREMENTS

FORM 01600-2

SECTION 01600
PRODUCT REQUIREMENTS

CERTIFICATE OF START-UP SERVICES

Project _____

Equipment _____

Specification Section _____

Contract _____

I hereby verify the equipment Manufacturers' Representative and the general contractor have inspected all equipment under this contract as installed, made adjustments and calibrations, and that the complete system as constructed is operating in conformance with the design, specifications, and manufacturer's requirements. Notation of improper operation shall be detailed and recommendations made and attached to this form.

MANUFACTURER'S REPRESENTATIVE

Signature _____ Date _____

Name (print) _____

Title _____

Representing _____

CONTRACTOR

Signature _____ Date _____

Name (print) _____

Title _____

ENGINEER

Signature _____ Date _____

Name (print) _____

Title _____

MOHAVE COUNTY, DEPARTMENT OF PUBLIC WORKS

Signature _____ Date _____

Name (print) _____

Title _____

COMMENTS: _____

Complete and submit two copies of this form to ENGINEER upon completion. Contact ENGINEER for coordination and scheduling 2 weeks prior to proposed date of start-up service. NOTE: Individual manufacturers may sign under the comments section of this form.

SECTION 01600
PRODUCT REQUIREMENTS

FORM 01600-3
CERTIFICATE OF POST START-UP SERVICES

Project _____

Equipment _____

Specification Section _____

Contract _____

I hereby verify the equipment Manufacturers' Representative and the general contractor have inspected all equipment under this contract as installed, made adjustments and calibrations, and that the complete system is operating in conformance with the design, specifications, and manufacturer's requirements. Notation of improper operation shall be detailed and recommendations made and attached to this form.

MANUFACTURER'S REPRESENTATIVE

Signature _____ Date _____

Name (print) _____

Title _____

Representing _____

CONTRACTOR

Signature _____ Date _____

Name (print) _____

Title _____

ENGINEER

Signature _____ Date _____

Name (print) _____

Title _____

MOHAVE COUNTY, DEPARTMENT OF PUBLIC WORKS

Signature _____ Date _____

Name (print) _____

Title _____

COMMENTS: _____

Complete and submit two copies of this form to ENGINEER upon completion. Contact ENGINEER for coordination and scheduling 2 weeks prior to proposed date of start-up service. NOTE: Individual manufacturers may sign under the comments section of this form.

SECTION 01600
PRODUCT REQUIREMENTS

FORM 01600-4
END OF SECTION -

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SECTION 01740
CLEANING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Disposal requirements.

B. Materials.

C. Cleaning during construction.

D. Dust control

E. Final cleaning.

1.02 DISPOSAL REQUIREMENTS

A. Conduct cleaning and disposal requirements to comply with codes, ordinances, regulations, and anti pollution laws.

PART 2 PRODUCTS

2.01 MATERIALS

A. Use only those cleaning materials which will not create hazards to health or property and which will not damage surfaces.

B. Use only those cleaning materials and methods recommended by manufacturer of surface material to be cleaned.

C. Use cleaning materials only on surface recommended by cleaning material manufacturer.

PART 3 EXECUTION

3.01 CLEANING DURING CONSTRUCTION

A. Execute periodic cleaning to keep Work, site, and adjacent properties free from accumulations of waste materials, rubbish, and windblown debris, resulting from construction operations.

B. Provide on site containers for collection waste materials, debris, and rubbish.

C. Remove waste materials, debris, and rubbish from site periodically and dispose of at legal disposal areas away from site.

3.02 DUST CONTROL

A. Clean interior spaces prior to start of finish painting and continue cleaning on an as needed basis until painting is finished.

B. Schedule operations so that dust and other contaminants resulting from cleaning process will not fall on wet or newly coated surfaces.

3.03 FINAL CLEANING

A. Employ skilled workers for final cleaning.

B. Remove grease, mastic, adhesives, dust, dirt stains, fingerprints, labels, and other foreign materials from sight exposed interior and exterior surfaces, as well as all tools, appliances, construction equipment and machinery, and surplus materials.

C. Wash and shine glazing and mirrors.

D. Polish glossy surfaces to clear shine.

E. Ventilating systems:

1. Clean permanent filters and replace disposable filters if units were operated during construction.

2. Clean ducts, blowers, and coils if units were operated without filters during construction.

F. Broom clean exterior paved surfaces; rake clean other surfaces of the grounds, so as to leave site ready for occupancy by OWNER, and restore those portions of site not designated for alteration by Contract Documents to their condition as of beginning of Work.

G. Prior to final completion, or OWNER occupancy, CONTRACTOR shall conduct inspection of sight exposed interior and exterior surfaces, and all work areas, to verify that entire Work is clean.

- END OF SECTION -

SECTION 01770
CLOSEOUT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Substantial completion.

B. Final completion.

C. Reinspection fees.

D. Closeout submittals.

E. Adjustment of accounts.

F. Application for final payment.

1.02 SUBSTANTIAL COMPLETION

A. When CONTRACTOR considers Work is substantially complete, submit written notice, with list of items to be completed or corrected.

B. Within reasonable time, OWNER and ENGINEER will inspect to determine status of completion.

C. Should OWNER or ENGINEER determine that Work is not substantially complete; it will promptly notify CONTRACTOR will be promptly notified in writing, giving reasons therefore.

D. CONTRACTOR shall remedy deficiencies, and send second written notice of substantial completion, and OWNER and ENGINEER will reinspect Work.

E. When OWNER and ENGINEER determine that Work is substantially complete, a Certificate of Substantial Completion will be prepared in accordance with General Conditions.

1.03 FINAL COMPLETION

A. When CONTRACTOR considers Work is complete, it shall submit written certification that:

1. Contract Documents have been reviewed.
2. Work has been inspected for compliance with Contract Documents.
3. Work has been completed in accordance with Contract Documents, and deficiencies listed with Certificate of Substantial Completion have been corrected.
4. Equipment and systems have been tested in presence of OWNER'S Representative and are operational.
5. Work is complete and ready for final inspection.

B. OWNER and ENGINEER will inspect to verify status of completion with reasonable promptness.

C. Should OWNER or ENGINEER consider that Work is incomplete or defective, CONTRACTOR will be promptly notified in writing, listing incomplete or defective Work.

D. CONTRACTOR shall take immediate steps to remedy deficiencies and send second written certification that Work is complete, and OWNER and ENGINEER will reinspect Work.

E. When OWNER and ENGINEER find Work is acceptable, it will consider closeout submittals.

1.04 REINSPECTION FEES

A. Should ENGINEER perform reinspections due to failure of Work to comply with claims made by CONTRACTOR, OWNER will compensate ENGINEER for such additional services and deduct amount of such compensation from final payment to CONTRACTOR.

1.05 CLOSEOUT SUBMITTALS

A. Evidence of compliance with requirements of governing authorities.

B. Certificate of occupancy.

C. Project record documents: In accordance with Section 01780.

D. Operation and maintenance data, instructions to OWNER'S personnel: In accordance with Section 01785.

E. Warranties and Bonds: In accordance with Section 01780.

F. Evidence of payment and release of liens: In accordance with General and Supplementary Conditions.

G. Consent of Surety to final payment.

H. Certificates of insurance for products and completed operations: In accordance with Supplementary Conditions.

1.06 ADJUSTMENT OF ACCOUNTS

A. Submit final statement of accounting, reflecting adjustments to Contract Price:
   1. Original Contract Price.
   2. Additions and deductions resulting from:
      a. Previous Change Orders.
      b. Allowances.
      c. Unit prices.
      d. Deductions for uncorrected Work.
      e. Penalties and bonuses.
      f. Deductions for liquidated damages.
      g. Deductions for reinspection payments.
      h. Other adjustments.

3. Total Contract Price, as adjusted.
4. Previous payments.
5. Sum remaining due.

B. ENGINEER will issue final Change Order, reflecting approved adjustments to Contract Price not previously made by Change Orders.

1.07 APPLICATION FOR FINAL PAYMENT

A. Submit Application for Final Payment in accordance with procedures and requirements in conditions of Agreement.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

- END OF SECTION -

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SECTION 01780
CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Maintenance of documents and samples.

B. Marking devices.

C. Recording.

D. Submittal.

1.02 MAINTENANCE OF DOCUMENTS AND SAMPLES

A. Maintain at Site for OWNER one record copy of:

1. Drawings.
2. Specifications.
3. Addenda.
4. Change Orders and other Modifications to Agreement.
5. ENGINEER'S Instruction to CONTRACTOR or written instructions.
6. Reviewed Shop Drawings and Samples.
7. Field test records.
8. Construction photographs.

B. Store documents and Samples in CONTRACTOR'S field office apart from documents used for construction.

1. Provide files and racks for storage of documents.
2. Provide locked cabinet or secure storage space for storage of Samples.

C. File documents and Samples in accordance with Construction Specifications Institute (CSI) format.

D. Maintain documents in clean, dry, legible condition and in good order. Do not use record documents for construction purposes.

E. Make documents and Samples available at all times for reference by ENGINEER.

1.03 MARKING DEVICES

A. Provide felt tip marking pens for recording information in color code designated by ENGINEER.

1.04 RECORDING

A. Label each document "PROJECT RECORD" in neat large printed letters.

B. Record information concurrently with construction progress. Do not conceal any Work until required information is recorded.

C. Drawings shall be legibly marked to record actual construction:

1. Depths of various elements of foundation in relation to finish first floor datum.
2. Horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
3. Location of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of structure.
4. Field changes of dimension and detail.
5. Changes made by Instruction to CONTRACTOR or by Change Order.
6. Details not on original contract Drawings.

D. Specifications and Addenda shall be legibly marked to record:

1. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.
2. Changes made by Instruction to CONTRACTOR or by Change Order.

1.05 SUBMITTAL

A. At Agreement close out, deliver record documents to ENGINEER for OWNER.

B. Accompany submittal with transmittal letter in duplicate, containing:

1. Date.
2. Project title and number.
3. CONTRACTOR'S name and address.
4. Title and number of each record document.
5. Signature of CONTRACTOR or its authorized representative.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

- END OF SECTION -

SECTION 01785
OPERATING AND MAINTAINENCE DATA

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Operating and maintenance data requirements.

B. Quality assurance.

C. Form of submittals.

D. Content of manual.

E. Manual for materials and finishes.

F. Manual for equipment and systems.

G. Submittal schedule.

H. Instruction of OWNER'S personnel.

1.02 OPERATING AND MAINTENANCE DATA REQUIREMENTS

A. Compile product data and related information appropriate for OWNER'S maintenance and operation of products furnished under Agreement.

B. Prepare operating and maintenance data as specified in this section and as referenced in other pertinent sections of Specifications.

C. Instruct OWNER'S personnel in maintenance of products and in operation of equipment and systems.

1.03 QUALITY ASSURANCE

A. Preparation of data shall be done by personnel:

1. Trained and experienced in maintenance and operation of described products.
2. Familiar with requirements of this section.
3. Skilled as technical writers to extent required to communicate essential data.
4. Skilled as draftsmen competent to prepare required drawings.

1.04 FORM OF SUBMITTALS

A. Prepare data in form of an instructional manual for use by OWNER'S personnel.

B. Format:

1. Size 8 ½" x 11".
2. Paper: 20 lb minimum, white, for typed pages.

3. Text: Manufacturer's printed data, or neatly typewritten.
4. Drawings:
   a. Provide reinforced punched binder tab, bind in with text.
   b. Fold larger drawings to size of text pages.
5. Provide flyleaf for each separate product, or each piece of operating equipment.
   a. Provide typed description of product, and major component parts of equipment.
   b. Provide indexed tabs.
6. Cover: Identify each volume with typed or printed title "OPERATING AND MAINTENANCE INSTRUCTIONS." List:
   a. Title of Project.
   b. Identity of separate structure as applicable.
   c. Identity of general subject matter covered in manual.
7. Binders:
   a. Commercial quality 3 ring binders with durable and cleanable plastic covers.
   b. Maximum ring size: 1".
   c. When multiple binders are used, correlate data into related consistent groupings.
8. Electronic O&M Manual:
   a. Electronic copy on CD.
   b. All text documents and drawings shall be in .PDF format.

1.05 CONTENT OF MANUAL

A. Neatly typewritten table of contents for each volume, arranged in systematic order.
   1. CONTRACTOR, name of responsible principal, address, and telephone number.
   2. List of each product required to be included, indexed to content of volume.
   3. List, with each product, name, address, and telephone number of:
      a. Subcontractor or installer.
      b. Maintenance contractor, as appropriate.
      c. Identify area of responsibility of each.
      d. Local source of supply for parts and replacement and list of recommended spare parts.
   4. Identify each product by product name and other identifying symbols as set forth in Contract Documents, including nameplate information and shop order numbers for each item of equipment furnished.

B. Product data:
   1. Include only those sheets which are pertinent to specific product.
   2. Annotate each sheet to:

a. Clearly identify specific product or part installed.

b. Clearly identify data applicable to installation.

c. Delete references to inapplicable information.

C. Drawings:

1. Supplement product data with Drawings as necessary to clearly illustrate:

a. Relations of component parts of equipment and systems.

b. Control and flow diagrams.

2. Coordinate Drawings with information in Project record documents to assure correct illustration of completed installation.

3. Do not use Project record documents as maintenance Drawings.

D. Written text, as required to supplement product data for particular installation.

1. Organize in consistent format under separate headings for different procedures.

2. Provide logical sequence of instructions for each procedure.

E. Copy of each warranty, Bond, and service contract issued.

1. Provide information sheet for OWNER'S personnel, giving:

a. Proper procedures in event of failure.

b. Instances which might affect validity of warranties or Bonds.

1.06 MANUAL FOR MATERIALS AND FINISHES

A. Submit 7 copies of complete manual in final form.

1. 5 hard copies.

2. 2 electronic copies on CD (1 to the OWNER, 1 to the ENGINEER).

B. Contents, for moisture protection and weather exposed products:

1. Manufacturer's data, giving full information on products.

a. Applicable standards.

b. Chemical composition.

c. Details of installation.

2. Instructions for inspection, maintenance, and repair.

C. Additional requirements for maintenance data: Respective sections of Specifications.

1.07 MANUAL FOR EQUIPMENT AND SYSTEMS

A. Submit 7 copies of complete manual in final form.

1. 5 hard copies.

2. 2 electronic copies on CD (1 to the OWNER, 1 to the ENGINEER).

B. Contents, for each unit of equipment and system, as appropriate:

1. Description of unit and component parts:
   a. Function, normal operating characteristics, and limiting conditions.
   b. Performance curves, engineering data, and tests.
   c. Complete nomenclature and commercial number of replaceable parts.
2. Operating procedures:
   a. Startup, break in, routine, and normal operating instructions.
   b. Regulation, control, stopping, shutdown, and emergency instructions.
   c. Summer and winter operating instructions.
   d. Special operating instructions.
3. Maintenance procedures:
   a. Routine operations.
   b. Guide to "trouble shooting."
   c. Disassembly, repair, and reassembly.
   d. Alignment, adjusting, and checking.
4. Servicing and lubrication schedule: List of lubricants required.
5. Manufacturer's printed operating and maintenance instructions.
6. Description of sequence of operation by control manufacturer.
7. Original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
   a. Predicted life of parts subject to wear.
   b. Items recommended to be stocked as spare parts.
8. As installed control diagrams by controls manufacturer.
9. List of original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.
10. Other data as required under pertinent sections of Specifications.

C. Content, for each electrical and electronic system, as appropriate.

1. Description of system and component parts:
   a. Function, normal operating characteristics, and limiting conditions.
   b. Performance curves, engineering data, and tests.
   c. Complete nomenclature and commercial number of replacement parts.
2. Circuit directories of panelboards:
   a. Electrical service.

b. Controls.

c. Communications.

3. As installed color coded wiring diagrams.

4. Operating procedures:

a. Routine and normal operating instructions.

b. Sequences required.

c. Special operating instructions.

5. Maintenance procedures:

a. Routine operations.

b. Guide to "trouble shooting."

c. Disassembly, repair, and assembly.

d. Adjustment and checking.

6. Manufacturer's printed operating and maintenance instructions.

7. List of original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.

8. Other data as required under pertinent sections of Specifications.

D. Prepare and include additional data when need for such data becomes apparent during instruction of OWNER'S personnel.

E. Additional requirements for operating and maintenance data: Respective sections of Specifications.

1.08 SUBMITTAL SCHEDULE

A. Preliminary draft:

1. Provide 2 copies with equipment.

2. Submit 2 copies to OWNER and ENGINEER.

3. Submit 2 copies to ENGINEER of proposed formats and outlines of contents prior to start of Work. ENGINEER will review draft and return 1 copy with comments.

B. Submit one copy of completed data in final form 15 days prior to final inspection or acceptance. Copy will be returned after final inspection or acceptance, with comments.

C. Submit specified number of copies of approved data in final form 10 days after final inspection or acceptance.

1.09 INSTRUCTION CITY'S PERSONNEL

A. Prior to final inspection or acceptance, fully instruct CITY'S designated operating and maintenance personnel in operation, adjustment and maintenance of products, equipment and systems.

SECTION 01785
OPERATING AND MAINTAINENCE DATA

B. Manual for equipment and systems shall constitute basis of instruction. Review contents of manual with personnel in full detail to explain all aspects of operations and maintenance.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

- END OF SECTION -

SECTION 02200
EARTHWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnishing labor, equipment, materials, and services, including site excavation and embankment, underground yard piping, reservoir foundations, electrical conduit and electrical structure excavating, backfilling and compacting.

B. Loosening, removing, loading, transporting, depositing, and compacting in its final location of materials wet and dry.

C. Furnishing, placing, and removing of sheeting and bracing necessary to safely support sides of excavation.

D. Pumping, ditching, draining, and other required measures for removal or exclusion of water from excavation.

E. Disposal of excess excavated materials.

F. Borrow of materials to make up deficiencies for fills.

G. Other incidental earthwork in accordance with requirements of Contract Documents.

1.02 QUALITY ASSURANCE

A. Standard Specifications: "Uniform Standard Specifications for Public Works' Construction, Off Site Improvements", Maricopa Association of Governments, most recent edition. The standards are referenced in this section as "Standard Specifications."

1. Comply with referenced sections and subsections of Standard Specifications.
2. Contractual, measurement, and payment provisions of Standard Specifications do not apply.
3. Applicable Sections:
   a. Section 206 – Structural Excavation and Backfill.
   b. Section 601 - Trench Excavation, Backfilling, and Compaction.
   c. Section 702 – Base Materials.

PART 2 PRODUCTS

2.01 MATERIALS

A. Type II aggregate base: Section 206 of Standard Specifications.

B. Selected backfill: Section 702 of Standard Specifications.

C. Granular structural backfill: Section 206 of Standard Specifications.

D. Soluble sulfate content: Less than 0.3% by dry soil weight for all backfill materials.

E. Crushed rock: Section 702.1 of Standard Specifications.

F. Sand: Section 701 of Standard Specifications and the following additional requirements:

1. Electrical resistivity greater than 5,000 ohm-centimeters when saturated with distilled water and tested using the soil box method in accordance with ASTM G57.
2. pH greater than 6.0 when saturated with distilled water and tested in accordance with ASTM G51.

PART 3 EXECUTION

3.01 PREPARATION

A. Inspect and verify site of excavation.

B. Verify location of concrete structures, if any.

3.02 EXCAVATION

A. Clearing and Grubbing

1. This work shall consist of removing objectionable material from the site.
2. Existing improvements, adjacent property, utilities, and other facilities, and trees and plants not to be removed, shall be protected from injury or damage resulting from the contractors operations.
3. For the full width of all water courses within the right-of-way lines, no stump, root, or other obstruction shall be left higher than the natural stream bed.
4. From excavated areas, all stumps, roots, and other obstructions 3 inches or over in diameter shall be grubbed to a depth of not less than 18 inches below finish grade.
5. Cavities left below subgrade elevation by removal of stumps or roots shall be carefully backfilled and compacted.

B. Excavation under structure:

1. Excavation shall be performed as required to place structure foundation (i.e. ring wall) and floor including areas requiring Type II aggregate base.
2. Backfill with Type II aggregate base to lines and grades required to accomplish construction.
3. Compact backfill in maximum of 6" lifts to a minimum of 95% of its maximum density per ASTM D1557.
4. Remove unsuitable soil and backfill with granular structural backfill to bottom of Type II material.

C. Excavation for pipeline and utility trench: Excavate pipeline location to true lines and grades as shown on the Drawings.

D. Excavation under embankment:

1. Excavate subgrade area under embankment to expose undisturbed native soil.

2. Ground surface exposed after removal of unsuitable soils shall be scarified to a depth of at least 6", moisture-conditioned to above optimum moisture content for silt and clayey soils and within 2% of optimum for granular soils, and then compacted in accordance with ASTM D1557.
3. Scarification may be terminated if moderately hard to hard cemented soils are encountered when acceptable to ENGINEER.
4. Existing surficial fill may be considered suitable for structural support if documentation is available to verify that it was placed and compacted under controlled conditions.
5. Undocumented fill shall be completely removed and compacted.

E. Remove and exclude water, including stormwater, groundwater, irrigation water, etc. from excavations.

F. Use dewatering wells, well points, sump pumps, or other means to remove water and continuously maintain groundwater at a level at least 2' below bottom of excavation before excavation work begins.

G. Water shall be removed and excluded until backfilling is complete and field soil testing has been completed.

H. Discharge water so silting of storm drain piping, catch basins or drainage channels does not occur.

3.03 EXPLOSIVES AND BLASTING

A. Blasting not permitted.

3.04 PIPELINE AND UTILITY TRENCH BACKFILL

A. Before pipe installation, remove unsuitable material, place bedding or base from bottom of excavation to designed elevation using Type II aggregate base. Bedding material shall be compacted to at least 95% maximum density per ASTM D1557.

B. After pipe has been installed, tamp pipe haunches and backfill around pipe maximum of 6" lifts to a height of 12" above top of pipe. Compact backfill to at least 95% maximum density.
1. Pipe zone backfill:
   a. Ductile iron pipe (DIP): Type II aggregate or crushed rock.
   b. Polyvinyl chloride (PVC): Type II aggregate.
   c. Welded steel pipe: Crushed rock.

C. Backfill remainder of trench with Type II aggregate base or select backfill compacted to a minimum of 95% maximum density per ASTM D1557.

D. Do not use clay material or drain backfill, known locally as pea gravel, as backfill for pipe.

E. Use mechanical compaction only.

3.05 DISPOSAL OF EXCAVATED MATERIALS

A. Remove excess excavated material and excavated material unsuitable for backfill, as determined by OWNER, from site of Work and dispose of at no expense to OWNER at locations to be approved by OWNER.

B. Arrange for disposal of excess materials.

3.06 SITE GRADING

A. Perform earthwork to lines and grades as shown and/or established by OWNER, with proper allowance for topsoil where specified or shown. Shape, trim, and finish slopes of channels to conform with lines, grades, and cross sections shown

B. Make slopes free of all exposed roots and stones exceeding 3" diameter which are loose and liable to fall.

C. Round tops of banks to circular curves, in general, not less than a 6' radius. Rounded surfaces shall be neatly and smoothly trimmed. Neatly blend all new grading into surrounding, existing terrain.

D. Finished site grading will be reviewed by OWNER.

3.07 FIELD TESTING

A. Sampling and testing of backfill material shall be done by agency or laboratory provided in Section 01400:

1. Test data submitted shall unmistakably identify name of testing laboratory, location of source of stockpiled material, date of sampling, date of tests, and shall be signed by registered professional engineer in responsible charge.
2. Obtain samples of proposed backfill material directly at source by testing laboratory.
3. OWNER shall determine how many and from where test samples shall be obtained.
4. No test data for proposed backfill material will be accepted by OWNER unless proposed backfill material has been sampled and tested within 1 year from date of submittal.
5. Provide test data required herein at no additional cost or expense to OWNER.

B. Allow sufficient time during construction operations for performance of control testing deemed necessary by OWNER.

1. Permit testing agency or laboratory to make field density tests of compacted backfill layer prior to placing additional backfill material.
2. Rework and recompact any layer, or portion thereof, that does not meet density requirements until it does meet specified density requirements at no additional cost to OWNER.

C. Tests made by testing agency or laboratory and accepted by the ENGINEER and OWNER for verifying compliance with backfill density requirements shall constitute ultimate authority as to acceptability of backfill density.

D. CONTRACTOR is not precluded from making or having made additional soil tests for his own information and satisfaction; however, except when specifically agreed to in writing by OWNER, tests made by CONTRACTOR or by other party not authorized by OWNER shall not take precedence over test results accepted under 3.06 C above.

- END OF SECTION -

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SECTION 02235
AGGREGATE BASE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Type II base including subgrade preparation, hauling, spreading, moisture control, compacting, and material tests.

1.02 SUBMITTAL

A. Laboratory test results indicating conformance of all materials in this Section.

PART 2 PRODUCTS

2.01 MATERIALS

A. Aggregate base shall be as specified in the Section 702 of the MAG Standard Specifications, Arizona, latest edition.

PART 3 EXECUTION

3.01 CONSTRUCTION

A. Prior to placing aggregate base, prepare subgrade in a manner meeting requirements specified herein.

B. Moisture content shall be sufficient to prevent segregation of aggregate and to obtain satisfactory compaction. Use of a central mixing plant to obtain moisture content will be permissible, but wetting aggregate in cars, bins, stockpiles, or trucks will not be permitted.

C. Construct base in layers not more than 4" compacted thickness, except that if tests indicate desired results are being obtained, compacted thickness of any layer may be increased to a maximum of 8".

D. Immediately after material has been placed with spreader, compact with tamping roller, vibratory roller, pneumatic-tired roller, or with combination of any roller types to a density of not less than 95% maximum density determined in accordance with ASTM D1557.

E. Compaction of top layer shall continue until aggregates are completely interlocked and stable and all movement of material stops. Give top layer final rolling with 3-wheel or tandem roller.

F. If any subgrade material is worked into base material during the compacting or finishing operations, remove granular material within affected area and replace with new aggregate.

- END OF SECTION -

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SECTION 02371
GEOTEXTILE FABRIC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Site preparation.

B. Plastic filter fabric.

C. Material testing.

1.02 RELATED SECTIONS

A. Section 01330 - Submittals.

B. Section 02200 - Earthwork.

1.03 SUBMITTALS

A. Submit mill certificate or affidavit attesting fabric furnished meets chemical, physical, and manufacturing requirements specified.

B. Submit 1 sample (8" x 11") of each type of fabric being furnished.

C. Submit manufacturer's recommended procedures for handling, storage, installation, and seam joining.

1.04 DELIVERY, HANDLING, AND STORAGE

A. During shipment, handling, and storage, plastic filter fabric shall be protected from direct sunlight, ultraviolet rays, temperatures greater than 140°F, mud, dirt, dust, and debris.

B. To maximum extent possible, fabric shall be maintained wrapped in heavy-duty protective covering.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. TC Mirafi "Mirafi 180 N."

B. SI Geosolutions, "Geotex 801."

C. Amoco Fabrics and Fibers Company, 260 The Bluffs, Austell, Georgia 30168.

D. Or equal.

SECTION 02371
GEOTEXTILE FABRIC

2.02 MATERIALS

A. Plastic filter fabric: Pervious nonwoven long-chain synthetic polymer filaments of polypropylene, polyester or polyethylene.

B. Fabric may be needle punched, heat-bonded, resin-bonded, or combinations thereof.

C. Material shall exhibit the following minimum physical properties:

1. Weight: 8 oz/yd^3, ASTM D5261.
2. Grab tensile strength: 200 lb, ASTM D4632.
3. Grab elongation: 50%, ASTM D4632.
4. Mullen burst: 400 lb/in^2, ASTM D3786.
5. Puncture: 125 lb, ASTM D4833.
6. Trapezoid tear: 80 lb, ASTM D4533.

D. Material shall contain stabilizers and inhibitors to make filament resistant to ultraviolet and heat deterioration.

2.03 SEAMS

A. Sew seams of fabric with thread of material meeting chemical requirements specified for plastic yarn, or bond by cementing or by heat.

B. Test seams in accordance with ASTM D1683, using 1" square jaws and 12" per minute constant rate traverse. Strengths shall be not less than 90% of required tensile strength specified, or of unaged fabric in any principal direction.

2.04 SECURING PINS

A. Material: Steel, 3/16" diameter, pointed at one end and fabricated with head to retain steel washer having outside diameter of not less than 1.5".

B. Length: Not less than 12".

PART 3 EXECUTION

3.01 SITE PREPARATION

A. Prior to installation of fabric, application surface shall be cleared of debris, sharp objects, tree roots, and stumps.

B. Prepare surface to receive fabric to relatively smooth condition free of obstructions, depressions, debris, and soft or low density pockets of material.

3.02 INSTALLATION

A. Place fabric in manner and at locations shown on Drawings.

SECTION 02371
GEOTEXTILE FABRIC

B. At the time of installation, fabric shall be rejected if it has defects, rips, holes, flaws, deterioration, or damage incurred during manufacture, transportation, or storage.

C. Insert securing pins with washers through both strips of overlapped fabric at not greater than 3' intervals along a line through midpoint of overlap. Additional pins, regardless of location, shall be installed as necessary to prevent any slippage of filter fabric.

D. Protect fabric at all times during construction from contamination by surface runoff, and any fabric so contaminated shall be removed and replaced with uncontaminated fabric.

E. Place material on fabric by spreading dumped material off of previously placed material with bulldozer blade or end-loader, in such manner as to prevent tearing or shoving of cloth. Dumping of material directly on fabric will only be permitted to establish an initial working platform. No vehicles or construction equipment shall be allowed on fabric prior to placement of granular blanket.

A. Unless otherwise specified, granular material shall be placed to full required thickness and compacted to satisfaction of OWNER before any loaded trucks are allowed on blanket.

G. Any damage to fabric during its installation or during placement of granular material shall be replaced by CONTRACTOR at no cost to OWNER.

H. Torn fabric may be patched in-place by placing piece of same fabric over tear. Dimensions shall be at least 2" larger than largest dimension of tear, and it shall be pinned to prevent granular material from causing lap separation.

I. Work shall be scheduled so that covering of fabric with layer of specified material is accomplished within 7 days after placement of fabric. Failure to comply shall require replacement of fabric.

- END OF SECTION -

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SECTION 02510
WATER SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe and fittings for water lines including end caps, supports, bolts, nuts, jointing materials, restrainer or thrust blocks, and ancillary items.

B. Valves, fire hydrants and other water appurtenances.

C. Testing and disinfecting of water lines and appurtenances.

1.02 QUALITY ASSURANCE

A. Shop Inspection: Furnish certified copies of mill test reports certifying compliance with AWWA D100, Section 11.1.

B. Prepare written report certifying work was inspected as set forth in AWWA D100, Section 11.2.1.

C. Work shall meet requirements of applicable AWWA Standards.

1.03 SUBMITTALS

A. Product Data: Provide data on pipe materials, pipe fittings, valves, and all accessories.

B. Manufacturer's certificates: Certify that products meet or exceed specified requirements.

1.04 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of piping, connections, and invert elevations.

B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products to site under provisions of Section 01600 and Water Standards.

B. Deliver and store valves in shipping containers with labeling in place.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturers of water pipes and accessories acceptable to OWNER and in compliance with Water Standards may be used.

2.02 CEMENT-LINED DUCTILE IRON PIPE

A. Pipe:

1. Design: AWWA C150.
2. Manufacture: AWWA C151.
2. Minimum thickness:
   a. Buried:
      1) 4" through 12": Pressure Class 350.
      2) 14" through 20": Pressure Class 250.
      3) 24": Pressure Class 200 except elsewhere specified.
   b. Exposed (flanged or grooved): Class 53.

B. Fittings:
   1. Buried: Mechanical joints, AWWA C153.
   2. Exposed:
      a. Flanged joints, AWWA C110; rated working pressure 150 psi or elsewhere specified.
      b. Grooved joints, AWWA C606; rated working pressure 150 psi or elsewhere specified.

C. Joints:
   1. Buried: Mechanical or push-on, AWWA C111.
   2. Exposed:
      a. Flanged, AWWA C111.
      b. Grooved, AWWA C606.
   3. Gasket:
      a. Buried: Styrene butadiene rubber.
      b. Exposed: Grade "M", halogenated butyl.
   4. Fitting joints: Type similar to that used for pipe; AWWA C110, C111, C115, C153, or C606.
   5. Bond all DIP 12" and larger.

D. Cement lining for pipe and fittings; AWWA C104.
   1. Thickness: Provide double thickness.
   2. Seal coat: Asphaltic material.

E. Include gaskets, glands, bolts, and nuts required for complete installation.

F. Mark each length of pipe with manufacturer's name and class.

G. Exterior coating for pipe and fittings: Asphaltic coating; AWWA C151.

H. Polyethylene encasement: Double layers of low-density, 8-mil minimum thickness each, tube-type, polyethylene film; color: blue, AWWA C105.

SECTION 02510
WATER SYSTEMS

2.03 COPPER TUBING

A. Type: ASTM B 88; Type K, soft temper for buried tubing and hard drawn for above ground or interior application.

B. Fittings: Soldered or sweated on; wrought copper conforming to ANSI B16.22.

C. Soldered joints shall contain 95% tin and 5% antimony.

D. Do not use solders or fluxes containing more than 0.2% of lead.

2.04 STEEL PIPING

A. Welded Schedule 40 black steel piping conforming to ASTM A53.

2.05 PVC PIPING

A. Design: ASTM D1785; Schedule 80 solid wall polyvinyl chloride (PVC) with solvent welded joints.

B. Perforation: Where indicated on the Drawings perforate the pipe with two rows of holes ½" diameter on 5" centers and 120° apart.

2.06 RESILIENT-SEATED GATE VALVES

A. Design and manufacture: AWWA C509.

B. Pressure rating: AWWA 200 psi.

C. Body and gate material: Ductile or cast iron.

D. Bonnet: Bolted.

E. Stem and trim: Bronze.

F. Use type permitting repacking under pressure when wide open.

G. Packing: O-ring.

H. Stem arrangement: Non-rising stem with 2" wrench nut.

I. Resilient seat: Applied to gate.

J. Direction of opening: Turn left to open.

K. Joint: Mechanical joint for buried installation.

L. Interior coating: Epoxy; AWWA C550.

M. Manufacturers: Only manufacturers of valves acceptable to OWNER and in compliance with Water Standards may be used.

2.07 BUTTERFLY VALVES

A. Type: Rubber seated, short body.

B. Valve bodies: Ductile iron conforming to requirements of AWWA C504, meeting Class 150B. Travel stops for disc on interior of body not allowed.

C. Valve seats: Hycar or Buna N; thickness shall meet or exceed requirements of AWWA C504. Seats shall be on valve body and not on disc.

D. Valve discs: Ductile iron or alloy cast iron conforming to ASTM A-126, Class B with 316 stainless steel disc edge.

E. Interior Coating: Epoxy; AWWA C550.

F. Valve shafts: Type 316 or 304 stainless steel. Shaft seals shall be designed for use of standard split "V" type packings.

G. Valve operators: Operating devices shall conform to requirements of AWWA C504. Operators shall be equipped with adjustable stop-limiting devices for both open and closed position.

1. Manual gear reduction type operators:

a. Type: Worm gear. Operating mechanism shall be totally enclosed, watertight, and gearing shall run in oil.

b. Gearing and material requirements: Conform to requirements of AWWA C504.

c. Operators: Self-locking to hold in any position.

d. Handwheels: Exposed butterfly valves shall be equipped with handwheels with adequate size to require an operating force of 40 lb or less.

e. Buried valves shall have 2" square operating nut.

f. Provide indicator to show position of valve disc for exposed installation.

H. Surfaces that mate with rubber seat of a butterfly valve to effect valve closure shall be Type 316 stainless steel in accordance with ASTM A276 or an alloy of nickel-chromium (nichrome). Thrust bearing surfaces of metal to metal shall not be exposed in flow stream of valve.

I. Design butterfly valves for maximum working pressure of 150 psi.

J. Manufacturer: DeZurk, Pratt, or equal

2.08 VALVE BOXES

A. Provide valve box for each buried valve.

B. Valve box shall be complete, assembled unit consisting of adjustable box and steel extension stem with 2" square operating nut.

C. Box section: adjustable box section shall consist of a top and bottom section with slide type extensions and large bottom base where specified.

D. Stem assembly: Extension stems shall be provided where depth of top of operating nut exceeds 5'. Extension stem shall be 1-1/4" round shaft fitted with a 2" AWWA nut and a self-centering device. The top of extension stem operating nut shall be punch marked a 1-1/2" high letter "E".

E. Equip lower end of box with self-centering alignment ring to center box over valve nut.

F. Lid shall be marked "Water".

G. Materials: Valve box and lid shall be cast iron.

H. Manufacturer: Acceptable to OWNER and in compliance with Water Standards may be used.

2.09 SLEEVE COUPLINGS

A. Construction: Steel middle ring, without pipe stop, 2 steel followers, 2 rubber compound wedge section gaskets suitable for maximum temperature of 240°F, and required number of track-head steel bolts to properly compress gaskets.

B. Harness-type lugs, tie rods, and nuts shall be furnished and installed where shown on Drawings. Harness-type connections shall be capable of withstanding working pressure of 150 psi.

C. Provide gap of not less than 1" nor more than 2" between ends of pipe.

D. Manufacturer: Romac Industries, Inc., JCM Industries, Inc., or equal.

2.10 FABRICATED TAPPING SLEEVES

A. Body: ASTM 283 Grade C or ASTM A-36 steel

B. Bolts: Corrosion resistant, high strength low alloy (AWWA C111, ANSI 21.11)

C. Flange: AWWA C207 Class D, ANSI 150 lb. Drilling, recessed for tapping valve MSS-SP60.

D. Gasket: Minimum 7/8" wide recessed Buna-N gasket around the outlet.

E. Finish: Heavy coat of corrosion resistant metal primer.

F. Service rating: 4" to 12" outlets – 175 psi.

G. Manufacturer: JCM Industries, Inc., or equal.

2.11 MECHANICAL-TYPE COUPLINGS

A. Conform to ANSI/AWWA C606.

B. Use nominal size less than 12" with cut-groove standard IPS pipe. Anvil International Gruvlock 7001, Victaulic Style 31, or equal.

C. Bolts, nuts and washers

1. Buried couplings: Cadmium plated, high-strength, low-alloy steel meeting composition requirements of AWWA C111, Type 304 or 316 stainless steel.

2. Other installations: AWWA C111. Type II Service Class 1, zinc-plated bolts, nuts and washers are also acceptable.

2.12 JOINT RESTRAINT

A. Provide joint restraint where designated on the Drawings and where required by equipment manufacturer.

B. Rated pressure: 150 psi.

C. Style:

1. Ductile iron pipe.

a. Push on joints: EBAA Series EBAA Series 1700, US Pipe Field Lok, US Pipe TR Flex, or equal.

b. Mechanical joints: EBAA Series 1100, or equal.

2.13 COMBINATION AIR VALVES

A. Application: Vent large quantities of air when filling line and allow air to re-enter line when it is being drained; allow entrained air to be released while under pressure.

B. Type: Vertical, float-operated, automatic combination air valve.

C. Pressure rating: 150 psi.

D. Accessories: Inlet gate shut-off valve; vent cap.

E. Connections: Threaded; 1" inlet; 1" on air/vacuum valve; 3/16" orifice on air release valve.

F. Manufacturer: APCO Series 140, or equal.

PART 3 EXECUTION

3.01 EXAMINATION

A. Notify OWNER and CITY Quality Control at least 72 hours in advance of commencing construction operations for connections to existing water mains or installation of new water mains.

B. Verify that water main sizes, locations, and inverts are as indicated.

3.02 EXCAVATION AND BEDDING

A. Refer to Section 02200.

3.03 INSTALLATION

A. Maintain separation of water main from sewer piping in accordance with applicable codes.

B. Install pipe including valves and other accessories and appurtenances to indicated elevation in accordance with Water Standards.

3.04 DISINFECTION OF POTABLE WATER PIPING SYSTEM

A. Flush and disinfect system in accordance with AWWA C651.

3.05 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Water Standards.

- END OF SECTION -

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SECTION 02640
REINFORCED CONCRETE PIPE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section covers bar-cage reinforced concrete pipe with rubber-gasketed joints, flexible sealant joints, or mastic joints to be furnished and installed at the locations indicated on the Drawings.

B. Pipe shall be furnished and installed complete with all fittings, end sections, jointing materials and other necessary appurtenances.

C. Pipe trenching, bedding and backfill are covered in the Section 2200.

D. Except as modified or supplemented herein, the manufacture of reinforced concrete pipe shall be governed by ASTM C76.

1.02 SUBMITTALS

A. Drawing, specifications, schedules and other data showing complete details of the fabrication and construction of pipe and fittings, together with complete data covering all materials proposed for use, shall be submitted in accordance with the submittals section. The drawings and data shall include, but shall not be limited to, the following for each size of pipe:

1. Data on reinforcement.
2. Details of joints.
3. Details of fittings and specials.
4. Test reports.

1.03 DELIVERY AND HANDLING

A. Concrete culvert pipe shall not be delivered to the site until concrete control cylinders representing such pipe shall have attained a compressive strength of at least 80 percent of the specified minimum 28 day strength.

B. Concrete pipe and fittings shall be handled carefully and shall not be bumped or dropped. Hooks shall not be permitted to come in contact with joint surfaces. Use of lifting holes will not be permitted.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Pipe shall be manufactured by Ameron, CSR Hydroconduit, Geneva Pipe or equal.

2.02 BASIS OF DESIGN

A. The wall thickness of concrete culvert pipe shall be not less than ASTM C76, Wall B.

SECTION 02640
REINFORCED CONCRETE PIPE

2.03 MATERIALS

A. Reinforced concrete pipe (RCP): AASHTO M170. Diameter and class shown on Drawings.

1. Cement - ASTM C150, Type V.
2. Gaskets - ASTM C443. The polymer shall be synthetic rubber; natural rubber will not be acceptable.
3. Flexible Joint Sealant – Preformed butyl rubber sealant; Hamilton-Kent "Kent Seal No. 2", Press –Seal Gasket "E-Z Stik", K.T. Snyder "RUB'R-NEK", or Concrete Sealants "Conseal CS102" or "CS202".
4. Mastic – Trowel grade sewer sealing compound; Grahn "Anchor-Tite Plastic Mastic" or J.P. Petroleum Products "Tex-Mastic 726".

2.04 LENGTH

A. Except for fittings and closure pieces, each piece of pipe shall be not less than 6 feet long.

2.05 JOINTS

A. Joints shall conform to ASTM C76, and rubber-gasketed joints shall also conform to ASTM C443. Joint design shall be suitable for the joint sealing material to be used.

2.06 REINFORCEMENT

A. Circumferential reinforcement shall be full-circle type. Elliptical or part-circle reinforcement will not be acceptable. The total area of longitudinal steel shall be not less than 0.2 percent of the concrete cross-sectional area of Wall B. Longitudinal bars shall be spaced uniformly around the pipe and shall be continuous in each cage.

2.07 MARKING

A. Each pipe or fitting shall have plainly and permanently marked thereon:

1. Pipe class.
2. Date of manufacture.
3. Manufacturer's name or trademark.

B. Markings shall be indented in the pipe or painted thereon with waterproof paint.

PART 3 EXECUTION

3.01 PIPE INSTALLATION

A. Execute Work in the dry; provide pumping or drainage necessary to completely remove water from work area.

B. Commence at lowest point in line.

SECTION 02640
REINFORCED CONCRETE PIPE

C. Bedding: Provide firm, compacted foundation of uniform density throughout length of pipe; shape to provide full bearing contact for lower quadrant of pipe. Foundation shall be free from clods, frozen lumps, rocks, roots, or other foreign material.

D. Keep pipe clean of dirt and foreign material. Protect pipe from damage at all times.

E. Seal joints in RCP culverts with preformed flexible gasket or mastic joint sealer. When mastic joint sealer is used, completely fill joint with material after pipes have been brought together. Push or pull each section of pipe as tight as reasonably possible to section in place to ensure tight joints.

F. Fill handling holes in RCP culverts with a precast plug, seal, and cover with mastic or mortar.

G. Backfilling:

1. Use material excavated from site. Use best granular material available for placement under pipe haunches and for backfill on sides of pipe up to top of pipe.
2. Backfill material shall be free of clods, rocks, organic matter, and other deleterious material.
3. Placing and compacting:
   a. Place and compact soil under haunches and on sides of pipe with special care.
   b. Place backfill material simultaneously on both sides of pipe in layers not exceeding 6" in depth.
   c. Compact backfill material, under haunches and on sides of pipe up to top of pipe, to 95% as determined by ASTM D698.

H. Carry hand-compacted backfill sufficient height above top of pipe to eliminate possibility of damage to pipe by equipment.

I. Lay culvert pipe with camber to allow for embankment settlement.

1. Compute camber as 1" per 5' of cover over pipe.
2. Center of culvert shall be not higher than inlet of pipe.

- END OF SECTION -

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SECTION 02650
MORTAR LINED AND COATED STEEL PIPE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Steel piping including steel pipe, steel joint rings, mortar lining, reinforced mortar, rubber coating, gaskets, butt-straps, fittings, specials, and closure pieces.

1.02 DEFINITIONS

A. Tolerance: Deviation permitted in specified dimension that may be caused by inexactness of manufacturing process or construction technique, when best standards of manufacturing processes have been employed.

B. Steel plate specials: Bends, reducers, outlets, closure pieces, piping in structures, or other special shapes.

1.03 SUBMITTALS

A. Submit Shop Drawings for steel pipe, fittings, specials, and closure pieces 8" in diameter and larger.

B. Manufacturer of mortar lined and coated (MLC) steel pipe shall furnish Affidavit of Compliance stating that pipe, specials, fittings, cement-mortar lining and coating, and materials furnished for Work comply with Contract Documents and AWWA Standards.

C. Submit test results showing physical properties of materials used in manufacture of rubber gaskets to ENGINEER and OWNER in accordance with Section 4.13.6.3 of AWWA C200.

D. Notify ENGINEER and OWNER in writing of following:

1. Pipe manufacturing: Not less than 14 days prior to starting.
2. Not less than 5 days prior to start of each of following:
    a. Welding.
    b. Coating application.
    c. Lining application.
    d. Shop hydrostatic testing.

1.04 QUALITY ASSURANCE

A. Welders shall be qualified and certified under provisions of AWS D1.1 and ASME BPVC Sect. IX for shop welds.

B. Written weld procedure specifications required for welds both shop and field.

C. Design stulling for pipe, specials and fittings such that damage is avoided during handling, storage and installation.

D. Provide certified welding inspector (CWI) for shop and field welding. CWI shall supervise all nondestructive testing and evaluate results.

E. OWNER will conduct random nondestructive inspections at field-welded joints.

F. OWNER shall request CONTRACTOR to have nondestructive testing performed on welds by certified personnel.

G. Pipe manufacturer's written Quality Assurance/Control Plan.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Transporting:

1. Transport pipe using blocking and hold-downs during shipment to prevent movement or shifting.
2. When being transported, support pipe in manner which shall not permit distortion or damage to lining or coating.
3. Provide internal wood stull bracing at each pipe end to prevent pipe from becoming out-of-round prior to installation. Limit deflection to 1/2 of 1% of pipe diameter until pipe is joined together and backfilled.
4. Bulkhead ends of pipe with 10-mil thick plastic to prevent excessive drying of linings; bulkheads shall remain intact until pipe is installed.
5. Section of pipe or steel plate special that arrives at Site with damaged or torn bulkhead will be rejected by OWNER and that section shall not be placed into Work.
6. Legibly mark installation sequence number on pipe, fittings and specials in accordance with piping layout.

B. Handling:

1. Perform handling and lifting of pipe and pipe specials with belt slings.
2. Use minimum of 2 slings at approximately third points of each pipe section, bearing uniformly against pipe.
3. No metal shall bear against pipe during handling.
4. When not being handled, pipe shall be supported on timber cradles, sand or earth berms free of rock exceeding 3" in diameter, graded to eliminate point loads and provide uniform support along full length.
5. Pipe that is damaged as result of handling or transportation shall be repaired to satisfaction of OWNER or shall be removed and replaced as directed by OWNER.

PART 2 PRODUCTS

2.01 STEEL FOR CYLINDERS AND FITTINGS

A. Steel cylinders:

1. Materials used in fabricating steel cylinders shall be hot-rolled carbon steel sheets or plates.

2. Steel sheets shall conform to ASTM A570, Grade 33.
3. Plates shall conform to ASTM A283, Grade D or ASTM A36, except as modified herein.
4. Minimum yield point of steel used for fabrication of steel cylinders shall be 33,000 psi.
5. Material furnished shall be NSF 61 approved for use with potable water.

B. Steel plate specials:
1. Steel used in welded steel plate specials shall conform to requirements specified above.
2. Dimensions: AWWA C208.
3. Shop fabricate: No field fabrication will be allowed unless approved by ENGINEER.
4. Verify wall thickness with design calculations.

C. Wire reinforcement: Steel used for wire reinforcement shall conform to requirements of ASTM A82 or ASTM A185.

2.02 RUBBER GASKETS

A. Type: Section 4.13.6.2 of AWWA C200.

B. Use: Sealing of joints on mortar lined and coated steel pipe.

2.03 CEMENT MORTAR FOR PIPE LINING AND COATING

A. Cement: ASTM C150.
1. Pipe linings: Type II or Type V.
2. Pipe coatings: Type V only.

B. Fine aggregate: ASTM C33.

C. Water: Clean and free from organic matter, strong alkalies, vegetable matter, and other impurities.

2.04 MORTAR LINED AND COATED STEEL PIPE

A. Unless otherwise specified or shown, manufacture in accordance with AWWA C200 and AWWA C205.

B. Pipe furnished shall have clear inside diameter equal to diameter shown on Drawings or specified, subject to tolerances as specified, except for pipe that is 12" in diameter or less, which may be furnished in ANSI Schedule 30 or heavier steel pipe.

C. Except as otherwise provided, steel cylinder shall have minimum wall thickness as follows:

Design Pressure (psi)	Pipe Diameter (Inches)	Minimum Wall Thickness (Inches)
150	12	0.1046
150	24, 36, 42	0.250

D. Pipe and appurtenances shall be designed for maximum deflection of 2% under external loads.

E. Furnish pipe complete with rubber gaskets or welded joints, as indicated; provide specials and bends as required.

2.05 STEEL PLATE SPECIALS

A. Dimension in accordance with AWWA C208 and manufacture in accordance with AWWA C205.

B. Except as otherwise provided, steel plate specials shall be fabricated from steel plate and have minimum wall thickness as follows:

Design Pressure (psi)	Pipe Diameter (Inches)	Minimum Wall Thickness (Inches)
150	12, 24, 36, 42	0.250

C. Outlets:

1. Build into wall of pipe. Form by welding to cylinder, cast or fabricated steel fittings of suitable design before exterior mortar coating is placed around fittings.
2. 12" and smaller: At CONTRACTOR'S option, fabricated from Schedule 30 or heavier steel pipe in standard outside diameters; i.e., 12-3/4", 10-3/4", 8-5/8", and 4-1/2".
3. Unless otherwise shown or specified, reinforce outlets with diameters less than 50% of principal pipe diameter with collar pads.
4. Reinforce outlets with diameters from 50% to 75% of principal pipe diameter with wrapper plates.
5. Reinforce outlets with diameters greater than 75% of principal pipe diameter with crotch plates.
6. Design outlets in accordance with AWWA Manual No. M11.
7. Measurement from outside of principal pipe to face of flange shall be 9", unless otherwise shown.

D. Except as otherwise shown, where bends are specified, radius of bends shall be not less than 2-1/2 times pipe diameter or 10', which ever is less. At CONTRACTOR'S option, bend may be factory-welded to adjacent pipe section.

E. Except as otherwise shown, length of reducers shall be not less than 7 times difference in pipe diameters to be connected.

2.06 FABRICATION

A. Manufacture pipe in sections having nominal lengths of 20' to 40' except where shorter lengths are required on curves, at major street intersections, where closure or special sections are required, or where otherwise shown.

1. Pipe shall consist of welded steel cylinder with steel joint rings; either formed or attached, centrifugally placed mortar lining, and reinforced mortar coating.

2. Each end of each pipe section shall be provided with two wood stulls of suitable size wedged into position at right angles to each other, using at least one wedge at each end, to prevent pipe from becoming out-of-round prior to installation.
3. Additional bracing shall be used to limit deflection in any pipe section to not more than 1/2 of 1% of pipe diameter, and shall remain in place until sections of pipe are joined together and backfilled.
4. While pipe is stored in manufacturer's yard and while in transit to job site, pipe ends shall be bulk-headed with 10-mil thick plastic or other material approved to allow proper cure lining.
5. Bulkheads shall remain intact until pipe is installed.
6. Pipe shall be furnished complete with rubber gaskets, butt straps, and closure pieces where required.
7. Pipe shall have smooth dense interior surfaces and shall be free from fractures, excessive interior surface crazing, and roughness.
8. Each section of steel pipe, fittings, specials, and closure pieces shall be assigned "mark number" which shall be referenced on shop drawings and shall be stenciled on inside wall and outside wall of each pipe or special section. In fabricating specials, make mark corresponding to true vertical axis of fitting on top and bottom of specials.

B. Steel cylinders may be fabricated by using one or more steel sheets for each cylinder.
   1. Welding shall be by approved method which shall produce full penetration of weld.
      a. Welds may be either straight or spiral.
      b. Welds when tested shall develop tensile strength of adjoining sheets and conform to AWS D1.1, AWWA C206, approved welding procedure and referenced welding codes.
   2. After each cylinder has been completed with joint rings welded in place, but before lining and coating, it shall be tested in accordance with article "Source Quality Control."

C. Joints shall be of bell and spigot type, except where welded joints are specified.
   1. On finished pipe, circumference of inside bell ring contact surface shall not exceed circumference of outside spigot ring contact surface by more than 3/16". Clearance between bell and spigot shall, when combined with gasket groove configuration and gasket itself, provide watertight joints under operating conditions.
   2. Bell and spigot joints shall conform to details shown on Drawings.
   3. Welded gasketed joints shall not be used for reinforced joint.

D. Where welded joints are specified, pipe shall be provided with slip-bell joints or butt-strap joints for field welding.
   1. If butt-strap joints are to be provided, attach butt-strap sections to ends of pipe at manufacturer's plant. Field cutting not permitted.
   2. Half of each butt-strap shall be welded to upper half of pipe and remaining half of butt-strap shall be welded to lower half of adjoining pipe.
   3. Field and plant welding shall be as shown on Drawings.

4. Butt-straps shall be accurately aligned and retained in position during welding to ensure proper alignment of pipe upon installation.
5. Welded joints shall conform to details shown on Drawings.

E. Mortar lining used in steel piping and steel plate specials shall be placed in pipe to thickness specified herein. Steel plate specials larger than 16" in diameter shall have lining reinforced with 2" x 4" 13-gage welded steel wire mesh. Other requirements of mortar lining materials and processes shall be as specified in AWWA C205.

Pipe Diameter (inches)	Lining Thickness (inches)	Tolerances (inches)
Less than 24	3/8	-1/16 + 1/8
24 and greater	1/2	-1/16 + 1/8

F. Steel piping and steel plate specials shall have reinforced mortar coating applied over outer surfaces, unless otherwise specified herein.

1. Type V cement shall be used for mortar coatings.
2. Cement mortar mixture shall consist of one part cement to not more than 3 parts sand.
3. No more than 4-1/2 gallons of water shall be used per sack of cement.
4. Cement mortar coating shall be 1" thick with permitted tolerance of ±1/4".
5. For pipe and specials smaller than 48" in diameter, coating shall be reinforced with spirally wound 12-gage steel wire spaced at 1" centers or with 14-gage steel wire at 2" centers positioned approximately in center of mortar coating.
6. For pipe and specials 48" in diameter and larger, coating shall be reinforced with 2 layers of spirally-wound 12-gage wire spaced at 1" centers or with 14-gage steel wire spaced at 1/2" centers positioned at 1/3 points of mortar coating.
7. Ends of reinforcement strips shall be lapped 4" and free ends tied or looped to assure continuity of reinforcement.
8. Coating for steel plate specials may be reinforced with 2" x 4" 14-gage welded wire mesh instead of reinforcing specified above.
9. One layer of mesh positioned approximately in center of coating is required for specials smaller than 48" in diameter and 2 layers of mesh positioned at 1/3 points of coating are required for specials 48" in diameter and larger.

G. Steel plate specials shall be fabricated in accordance with following provisions in addition to those provisions specified above:

1. Hand welding shall be done by welders certified in accordance with Appendix II of ANSI B31.1 or in accordance with AWWA C206.
2. Where mechanical type couplings are shown, ends of pipe shall be supplied with Type D shoulders as shown in Figure 2 of AWWA C606. Where pipe smaller than 12" is furnished in standard diameters, and where wall thickness equals or exceeds manufacturer's minimum recommended wall thickness, pipe ends may be grooved.

3. Except as otherwise specified or shown on Drawings, flanges to be installed on pipe or fittings shall be faced and drilled in accordance with 150 lb ANSI dimensions, or in lieu thereof, shall be in accordance with AWWA C207, Class D or Class E, as applicable.

   a. Flanges shall be furnished with flat faces.

   b. Pipe flanges shall be attached with bolt holes straddling vertical axes of pipe, unless otherwise shown on Drawings.

   c. Attachment of flanges to pipe shall conform to applicable requirements of AWWA C207.

H. Steel pipe and fittings to be installed in structures shall have exterior surfaces thoroughly cleaned and coated with rust-inhibitive red lead primer.

1. Unless otherwise shown, exterior surfaces of pipe or fittings passing through structure walls shall be coated to point approximately 2" inside structure or wall flange if provided.

2. Exterior surfaces of pipe and fittings in structures or above ground shall be cleaned, primed, and finish-painted in accordance with Section 09900.

2.07 SOURCE QUALITY CONTROL

A. Inspection: Steel piping shall be subject to inspection at place of manufacture in accordance with AWWA C200 and C205.

B. Tests: Materials used in manufacture of steel piping shall be tested in accordance with requirements of AWWA C200 and C205, as applicable.

C. Welding Requirements:

1. Welding procedures used to fabricate steel piping shall be pre-qualified under provisions of AWS D1.1.

2. Welding procedures shall be required for, but not be limited to, longitudinal and girth or spiral welds for pipe cylinders, spigot and bell ring attachments, reinforcing plates and ring flange welds, and plates for lug connections.

D. After each steel cylinder has been completed with joint rings welded in place, but before lining and coating, it shall be tested under hydrostatic pressure in accordance with AWWA C200 Section 5.2. The cylinder shall show no leaks, undue distortion, or other defects.

1. Leaks shall be rewelded by hand and pipe again tested.

2. No caulking to stop leaks shall be permitted.

3. After pipe with welded bells has been hydrostatically tested, longitudinal welds in bell shall be tested by and in accordance with AWWA C200.

4. Upon completion of welding, but before lining and coating, each steel plate special shall be bulkheaded and tested under hydrostatic pressure of not less than 1-1/2 times design pipe pressure, provided, however, that if straight pipe used in fabricating specials has been previously tested, no further hydrostatic testing shall be required, and provided transverse seams are tested in accordance with AWWA C200.

5. Pin holes or porous welds revealed by test shall be chipped out and rewelded and pipe or fittings retested.

6. No outside mortar may be applied over seams prior to testing.
7. However, mortar lining may be applied over seams prior to hydrostatic testing, but under such conditions said pressure test shall be held on pipe or fitting for period of not less than 30 minutes.

PART 3 EXECUTION

3.01 PROTECTION

A. Pipe supports shall conform to pipe details where shown on Drawings provided that support for exposed piping shall be complete and adequate regardless of whether or not supporting devices are specifically shown.

B. At times when work of installing pipe is not in progress, openings into pipe and ends of pipe in trenches or structures shall be kept tightly closed.

C. Maintain inside of pipe free from foreign materials and in clean and sanitary condition until its acceptance.

D. Take necessary precautions to prevent pipe from floating due to water entering trench from any source, assume full responsibility for damage due to this cause, and restore and replace pipe to its specified condition and grade if it is displaced due to floating.

E. When pipe is laid, trenches shall be in reasonably dry condition and necessary facilities shall be provided for lowering and properly placing pipe sections in trench without damage.

F. Handling of mortar lined and coated steel piping shall be done with slings which shall not damage lining or coating of pipe sections. Sling shall bear uniformly against pipe. Use 2 slings, 1 at each end at 1/3 points.

G. When not being handled, pipe shall be supported on timber cradles.

H. Wood stull bracing shall remain in place until backfill operations are complete.

3.02 INSTALLATION OF STEEL PIPING

A. Unless otherwise specified or shown, furnish and install pipe, specials, fittings, closure pieces, thrust blocks, valves, supports, bolts, nuts, gaskets, jointing materials, and other appurtenances as shown on Drawings and as required to provide complete installation.

B. Laying pipe:

1. Lay pipe sections in trench to true alignment and grade in accordance with Drawings.
2. Maximum pipe laying lengths shall be 40" with shorter lengths provided as required.
3. Exceptional care shall be exercised in placing pipe.
4. Bumping of pipe in trench shall not be permitted.
5. Where closure sections are required by laying operations, sections shall be installed in accordance with applicable sections of these Specifications.

6. Pipe sections shall be closely jointed to form smooth flow lines.
7. Immediately before placing each section of pipe in final position for jointing, bedding for pipe shall be checked for firmness and uniformity of grade.

C. Rubber gasket joints:
1. Make joints by properly lubricating rubber gasket with suitable vegetable compound soap before it is placed in groove at spigot end.
2. Gasket shall be stretched over spigot end of pipe and carefully seated in groove.
3. Gasket shall not be twisted, rolled, cut, crimped, or otherwise damaged or forced out of position during closure of joint.
4. "Feeler" gage shall be used to check position of rubber gasket after bell and spigot ends of pipe joints have been joined together.

D. With pipe 24" in diameter and larger, after pipe zone bedding and backfill have been densified, inside joint recess of pipe shall first be cleaned and moistened, then filled and pointed with stiff cement mortar consisting of one part cement to 1-1/2 parts sand.
1. Finished joint shall be smooth and flush with adjacent interior pipe surfaces.
2. Interior joint pointing operations shall not be performed on 2 joints adjacent to pipe being installed until all pipe has been placed.

E. After joining pipe, exterior joint recess shall be cleaned and heavy-duty diaper or plastic or cloth band at least 8" in width shall be centered and secured over exterior joint recess.
1. Diaper shall be bound to pipe by use of steel box strapping or by equivalent approved method and shall completely and snugly encase outside joint except for an opening near top where mortar grout is to be poured into joint recess.
2. After diaper is properly secured, joint recess shall be flushed with water so that surface of joint to be in contact with grout shall be thoroughly moistened when grout is poured.
3. Joint recess shall be filled with grout consisting of 1 part Portland cement, Type V, and 2 parts sand mixed with water to consistency of thick cream.
   a. Grout shall be poured in one side of diaper only and shall be rodded with wire or other flexible rod or vibrated so that grout completely fills joint recess by moving down one side of pipe, around bottom of pipe, and up opposite side.
   b. Pouring and rodding grout shall be continued to allow completion of filling of entire joint recess in one operation.
   c. Grout shall completely fill outside annular space between ends of pipe and around complete circumference leaving no unfilled space.
   d. After joint recess has been filled, diaper shall be replaced over opening left for pouring and grout allowed to set before bedding and backfilling at joint proceeds.

F. Where welded joints are shown, bell end shall be circumferentially welded on inside or outside (optional) for pipe 36" in diameter and larger and on outside for pipe smaller than 36" in diameter, except where double welding is indicated (inside and outside).

1. Bell end shall be welded to spigot ends of adjoining pipe.
2. Welds shall be continuous and ample bell holes shall be dug to permit proper welding.
3. Field welds between bell and spigot ends shall be made in 2 or more passes so as to build up a fillet weld having a minimum thickness of 1/4", or total thickness of pipe shell, whichever is less.
4. Prior to welding, joint shall be made up as specified above, except that rubber gasket shall be omitted on pipe 36" in diameter and larger.
5. Such joints shall be inspected and approved by OWNER and CITY before protective coating is placed around outside of joint.
6. Welding shall be done in accordance with AWWA C206.
7. Thickness of welds on butt-straps and closure pieces shall be equal to thicker of 2 connecting steel thicknesses.
8. Where welded joints on interior of pipe require filler rod for proper welding, joint shall be welded on exterior of pipe. Do not use filler rod on interior welds. Do not use hydraulic jacks, sledgehammers or other devices to reshape pipe to allow for welding interior joints.

G. Where butt-strap or closure piece is used, both interior and exterior surfaces of butt-strap or closure piece shall be given coating equivalent to factory-applied coating of adjoining pipe sections.

1. Mortar coating shall be reinforced as specified above.
2. Mortar lining shall be similarly reinforced where exposed length of butt-strap or closure piece, as measured between ends of connected pipe sections, exceeds 4".
3. Butt-straps shall be provided with 5" diameter hand holes for placing of lining for pipe 30" in diameter and smaller.

3.03 CATHODIC PROTECTION

A. Provide corrosion mitigation and testing materials, such as magnesium anodes, reference electrodes, test lead wires, and test station boxes and accessories.

- END OF SECTION -

SECTION 02653
WATER PIPELINE TESTING AND DISINFECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements to perform cleaning and testing of all pipeline and appurtenant piping for potable water systems, in accordance with the Contract Documents and ADEQ Bulletin No. 8.

1.02 SUBMITTALS

A. A testing schedule, including proposed plans for water conveyance, control, disposal, health and safety plan, rate of discharge, acceptable discharge location, communications plan and contingency plans shall be submitted in writing for approval a minimum of 21 days prior to proposed testing start.

B. CONTRACTOR shall prepare and submit a log of all samples collected for bacteriological tests indicating facility, station number, free chlorine residual and pH. CONTRACTOR to provide a log of all appurtenances flushed with highly chlorinated water.

C. CONTRACTOR shall prepare and submit a procedure for final connection to the existing pipelines.

D. Submit Shop Drawings for steel pipe, fittings, specials, and closure pieces 8" in diameter and larger.

1.03 QUALITY ASSURANCE

A. The CONTRACTOR shall perform cleaning and testing of all pipelines, surge tank, and appurtenances for potable water, complete all in accordance with the Contract Documents.

PART 2 PRODUCTS

2.01 MATERIALS REQUIREMENTS

A. All test equipment, chemicals for chlorination, temporary valves, bulkheads, backflow prevention devices, pumps or other water control equipment and materials shall be determined and furnished by the CONTRACTOR subject to the ENGINEER'S review. No materials shall be used which would be injurious to the construction or its future function.

B. Gauges used in the test shall be accompanied with satisfactory certifications of accuracy from a laboratory approved by the ENGINEER.

C. Chlorine shall be in the form of liquid chlorine, sodium hypochlorite solution, or calcium hypochlorite granules or tablets.

D. Liquid chlorine shall be in accordance with the requirements of ANSI/AWWA B301. Liquid chlorine shall be used only:

1. In combination with appropriate gas flow chlorinators and ejectors;
2. Under the direct supervision of an experienced technician;
3. When appropriate safety practices are observed.

E. Sodium hypochlorite and calcium hypochlorite shall be in accordance with the requirements of ANSI/AWWA B300 - Hypochlorite.

SECTION 02653
WATER PIPELINE TESTING AND DISINFECTION

PART 3 EXECUTION

3.01 GENERAL

A. CONTRACTOR shall obtain a construction meter and pay fees for water for testing and disinfection.

1. CONTRACTOR shall make necessary provisions for conveying water from designated source to point of use.

2. Water for testing will be provided from Well #1 and Well #2.

B. All pressure pipelines shall be tested. Disinfection shall be accomplished by chlorination. All chlorinating and testing operations shall be performed in the presence of the ENGINEER.

C. Disinfection operations shall be scheduled as late as possible during the contract time period so as to assure the maximum degree of sterility of the facilities at the time the Work is accepted. Samples for bacteriological testing shall be completed by the CONTRACTOR, and testing shall be performed by the APPROVED laboratory and at the expense of the CONTRACTOR. Results of the bacteriological testing shall be satisfactory with the State Department of Health or other appropriate regulatory agency.

D. Pipeline pressure tests will include the following tests:

E. Hydrostatic pressure test of the complete pipeline, in segments as required to match pipe pressure class.

F. The CONTRACTOR shall obtain all required discharged permits. The CONTRACTOR shall notify local agencies, secure appropriate permits and approvals, and provide erosion control measures as appropriate.

3.02 HYDROSTATIC TESTING OF PIPELINES

A. Prior to hydrostatic testing, all pipelines shall be flushed, swept, or blown out as appropriate. Test all pipelines either in sections or as a unit. No section of the pipeline shall be tested until all field-placed concrete or mortar has attained an age of 14 days. The test shall be made by closing valves when available, or by placing temporary bulkheads in the pipe and filling the line slowly with water. The CONTRACTOR shall be responsible for ascertaining that all test bulkheads are suitably restrained to resist the thrust of the test pressure without damage to or movement of the adjacent pipe. Any unharnessed sleeve-type couplings, expansion joints, or other sliding joints shall be restrained or suitably anchored prior to the test, to avoid movement and damage to piping and equipment. Provide sufficient temporary air tappings in the pipelines to allow for evacuation of all entrapped air in each pipe segment to be tested. After completion of the tests, such taps shall be permanently plugged. Care shall be taken to see that all air vents are open during filling.

B. The hydrostatic test water shall contain 50 mg/l free chlorine. Potable water shall be used for hydrostatic testing of pipes. The pipeline shall be filled at a rate which will not cause any surges or exceed the rate at which the air can be released through the air valves at a reasonable velocity and all the air within the pipeline shall be properly purged. After the pipeline or section thereof has been filled, it shall be allowed to stand under a slight pressure for at least 24 hours to allow the concrete or mortar lining, as applicable, to absorb what water it will and to allow the escape of air from any air pockets. During this period, bulkheads, valves, and connections shall be examined for leaks. If leaks are found, corrective measures satisfactory to the ENGINEER shall be taken.

C. The hydrostatic Test shall consist of holding the test pressure on the pipeline for a period of four hours. The test pressure for the yard piping shall be 133 percent of the pressure class indicated. All visible leaks shall be repaired in a manner acceptable to the ENGINEER. Pipe with welded joints shall have no leakage. Leakage shall be considered the amount of water added to the pipe during the test.

D. Test each pipeline valve in closed position with test pressure maintained on one side and zero pressure on other side. Test valve in accordance with Section 15200 - Valves, General.

E. Pipelines that fail the hydrostatic pressure and leakage tests shall be rejected and the CONTRACTOR shall determine the cause of failure and rectify. After repairs are made the CONTRACTOR shall retest and demonstrate compliance to the pressure and leakage test criteria.

3.03 DISINFECTING PIPELINES

A. General: All potable water pipelines except those appurtenant to hydraulic structures shall be disinfected in accordance with the requirements of ANSI/AWWA C651 - Disinfecting Water Mains as modified herein.

B. Continuous Feed Method: Disinfect in accordance with ANSI/AWWA C651 except that:

1. The water in the pipe shall contain 50 mg/l free chlorine.

2. After 24 hours of disinfection, the residual free chlorine shall be at least 25 mg/l at the pipeline extremities.

C. Slug Feed Method: Disinfect in accordance with ANSI/AWWA C651.

D. Chlorinating Valves: During the process of chlorinating the pipelines, all valves and other appurtenances shall be operated while the pipeline is filled with the heavily chlorinated water.

E. Final Flushing: After the applicable retention period, the heavily chlorinated water shall be flushed from the pipeline until chlorine measurements show that the concentration in the water leaving the pipeline is no higher than that generally prevailing in the system or is acceptable for domestic use. If there is any question that the chlorinated discharge will cause damage to the environment, a reducing agent shall be applied to the water to neutralize thoroughly the chlorine residual remaining in the water.

F. Bacteriological Testing: After final flushing and before the pipeline is placed in service, a sample, or samples shall be collected by the CONTRACTOR from the end of the line, and shall be tested for bacteriological quality in accordance with the requirements of the State Department of Health or other appropriate regulatory agency. For this purpose the pipe shall be refilled with fresh potable water and left for a period of 24 hours before any sample is collected. Should the initial disinfection treatment fail to produce satisfactory bacteriological test results, the disinfection procedure shall be repeated at no additional cost to the OWNER until acceptable results are obtained.

3.04 CONNECTIONS TO EXISTING SYSTEM

A. Where connections are to be made to an existing potable water system, the interior surfaces of all pipe and fittings used in making the connections shall be swabbed or sprayed with a one percent hypochlorite solution before they are installed.

- END OF SECTION -

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SECTION 02821
CHAIN LINK FENCE AND GATE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fencing.

B. Signs.

C. Grounding.

1.02 RELATED SECTIONS

A. Section 03100 - Concrete Work.

B. Section 03300 - Cast-in-Place Concrete.

1.03 SUBMITTALS

A. Product Data on dimensions, materials, and finishes.

1.04 QUALITY ASSURANCE

A. Fencing shall meet or exceed minimum standards established by Chain Link Fence Manufacturers Institute Product Manual for materials, finishes, and installation.

B. Perform installation with experienced fence erectors under supervision of factory-authorized representative.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Anchor Fence Co.

B. United States Steel Corporation.

C. American Chain and Cable Company, Inc.

D. Colorguard Corporation.

2.02 FENCE MATERIALS

A. Fence height: 8' (2.44 m) to top of mesh and framing.

B. Fabric:
1. 2" (50 mm) diamond mesh, 9-gage (4 mm).
2. Tensile strength: 80,000 psi (550,000 kPa) minimum.
3. Top selvage: Twisted and barbed.
4. Bottom selvage: Knuckled.

SECTION 02821
CHAIN LINK FENCE AND GATE

C. Framework: ASTM F1043, Group 1A steel pipe; or ASTM F1043, Group 1C high-strength steel pipe. Pipe shall conform to following sizes and weights:

Sizes and Description	Outside Diameter, in (mm)	Weight, Group 1A lb/ft (kg/m)	Weight, Group 1C lb/ft (kg/m)
Top rail	1.660 (42)	2.27 (3.38)	1.40 (2.10)
Line post	2.375 (60)	3.65 (5.44)	3.12 (4.65)
End, corner, and pull post	2.875 (73)	5.79 (8.63)	4.64 (6.91)
Brace rail	1.660 (42)	2.27 (3.38)	1.40 (2.08)
Gate post:			
Up to 6' (1.8 m) wide	2.875 (73)	5.79 (8.63)	4.64 (6.91)
7' to 12' (2.1 m to 3.6 m) wide	4.000 (100)	9.11 (13.57)	6.56 (9.77)

D. Post tops: Post tops shall be so designed as to exclude moisture from post. C-section posts shall not require tops.

E. Tension wire: 6- or 7-gage (4 mm), zinc-coated wire.

F. Truss rods: 3/8" (10 mm) diameter, zinc-coated steel rod, adjustable.

G. Gate frame: Pipe, joined at corners by welding or fittings. Provide fabric and any necessary bracing and adjustable truss rods.

H. Gates: ASTM F900 swing type, or ASTM F1184 sliding type, as required, complete with necessary latches, stops, keepers, hinges or rollers and roller tracks, and provision for padlocking.

I. Fittings: Galvanized press steel, malleable, or ASTM F626 cast steel.

J. Finishes:
1. Chain link fabric: Steel galvanized after weaving by hot-dip process to give a minimum of 1.2 oz of zinc/sq ft (450 mg/m^2) of wire surface distributed over entire fabric, including cut ends, in accordance with ASTM A392 Class 1.
2. Galvanized steel frame and steel or galvanized steel appurtenances: Coat with 10 mils of bonded polyvinyl chloride. Bond shall exhibit equal or greater strength than cohesive strength of vinyl. Color of polyvinyl chloride coating shall be green, black, brown, olive, or green.
3. Chain link fabric: Coat with 15 mils (0.38 mm) minimum and 25 mils (0.64 mm) maximum of polyvinyl chloride extruded over and adhered to galvanized steel fabric. Bond shall exhibit equal or greater strength than cohesive strength of vinyl. Coat cut ends with vinyl at factory. Color of polyvinyl chloride coating shall be *green.* *black.* *brown.* *olive green.*
4. Framework:
   a. External coating:
      1) Steel pipe, ASTM F1043, Group 1A: Zinc-coated in accordance with paragraph 7.1.1.
      2) Steel pipe, ASTM F1043, Group 1C: Zinc with organic overcoat in accordance with paragraph 7.1.2.
   b. Internal coating:

1) Steel pipe, ASTM F1043, Group 1A: Zinc-coated in accordance with paragraph 7.2.1.
2) Steel pipe, ASTM F1043, Group 1C: Zinc-coated in accordance with paragraph 7.2.2.

2.03 SIGNS

A. Type: 18-gage (1.0 mm) steel sign with baked-on enamel background and large letters. ANSI Z535.1 through Z535.4.

B. Wording: PRIVATE PROPERTY
NO TRESPASSING!

C. Color: White letters on red background.

D. Size: 20" x 28" (500 mm x 700 mm).

E. Location: .

F. Quantity:

2.04 SPECIAL GROUNDING MATERIALS

A. Ground rods: 3/4" (19 mm) diameter x 10'-0" (3 m) copper-clad steel, sectional.

B. Ground bus: No. 4/0 AWG (120 mm^2) standard soft-drawn bare copper.

C. Connections; high conductivity copper alloy, nonferrous, noncorrosive:
1. Single cable to tubular member: Burndy Type GAR, or equal.
2. Double cable to tubular member: Burndy Type GD, or equal.
3. Flexible braid to tubular member: Burndy Type GD, or equal.
4. Double cable to H-beam member: Burndy Type GD-H, or equal.
5. Cable to barbed wire: Compression type high conductivity aluminum H-shape line tap, Burndy Type YHO, or equal.

D. Cable for fence connections to ground bus: No. 2 AWG (35 mm^2) solid tinned copper.

E. Connections to ground bus: Copper compression connectors; Burndy or exothermic welded; ERICO.

F. Gate to gate post connection: Flexible tinned copper braid.

2.05 GROUNDING MATERIALS

A. Ground rods: 3/4" (19 mm) diameter x 10'-0" (3 m) copper-clad steel, sectional.

B. Cable from fence connection to ground rod: Minimum No. 6 AWG (16 mm^2) solid copper.

C. Gate to gate post connection: Flexible tinned copper braid.

D. Clamp connectors: High conductivity copper alloy, nonferrous, noncorrosive; suitable for fence member and conductor. Burndy, or equal.

PART 3 EXECUTION

3.01 FENCE INSTALLATION

A. Spacing of posts:
   1. Space posts evenly for distance required unless specific spacing is shown.
   2. Maximum spacing: 10' c to c.

B. Set each post in concrete as follows:
   1. Diameter: 10" (250 mm) for line posts, 12" (300 mm) for corner posts, 18" (450 mm) for gate posts; crown concrete tops to shed water.
   2. Depth: Extend gate posts 5'-0" (1,500 mm) into 5'-6" (1,650 mm) foundation; other posts 3'-0" (900 mm) into 3'-6" (1,050 mm) foundation.
   3. Concrete: Class A, as specified in Section 03300.
   4. Form top 6" (150 mm) with "Sonotube," or equal.
   5. Line posts may be set with 1-1/2" x 1-1/2" x 30" (38 mm x 38 mm x 760 mm), drive anchors at Contractor's option.

C. Where fence turns corner or bends in excess of 30° horizontally or vertically, provide corner post complete with bracing.

D. Connect fabric securely to line posts and top rails using tie wires every 12" (300 mm) on posts and 24" (600 mm) on rails.

E. Provide necessary tie wires, clips, angles, and fastening devices to erect fence and gates to structural supporting elements.

F. Gates shall swing freely to open 120° upon completion of installation.

G. Install gates plumb, level, and secure for full opening without interference. Anchor center stops and keepers in concrete.

3.02 GROUNDING INSTALLATION

A. Drive tops of ground rods to depth of 2'-0" (610 mm) below grade.

B. Install clamp connectors in accordance with manufacturer's recommendations.

C. Install ground rods as follows:
   1. Crossing of primary electrical transmission line: 1 at crossing location and 1 at a distance 50' (15 m) each side of crossing.
   2. Adjacent to and within 50' (15 m) of a primary electrical transmission line: At least 1 in each uninterrupted run and not more than 500' (150 m) intervals.

D. Install ground rods at locations shown on Drawings.

E. Ground gates using flexible, tinned copper braid.

SECTION 02821
CHAIN LINK FENCE AND GATE

- END OF SECTION -

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SECTION 03100
CONCRETE FORMWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Design, furnish, and install formwork with shoring, bracing and anchorage for cast-in-place concrete.

B. Form all concrete unless permitted otherwise.

C. CONTRACTOR may use either wood or removable metal forms, at its option, except as otherwise specified or shown.

1.02 SUBMITTALS

A. All materials specified in this Section.

B. Manufacturer's data for form coating materials.

1.03 QUALITY ASSURANCE

A. Design, construct, and erect concrete forms in accordance with applicable provisions of ACI 117, 301, and 347 except as specified hereinafter. Permissive language in reference standards shall be considered as mandatory except where quality of work would be diminished.

B. Allowable tolerances: Construct and maintain forms to produce concrete dimensions not to exceed tolerances specified under ACI 117 and to fit with equipment and materials mounted to concrete.

PART 2 PRODUCTS

2.01 WOOD FORMS

A. Unexposed surfaces: Standard grade or better.

B. Exposed surfaces: Douglas fir, exterior type, concrete form plywood.

2.02 REMOVABLE METAL FORMS

A. Surfaces equal to Douglas fir, exterior type, concrete form plywood.

2.03 FORM COATING

A. Wood forms: Non-staining mineral oil or commercially produced form-release agent that will not bond with, stain, or adversely affect concrete surfaces and curing, and will not impair bond or adhesion of subsequent treatment of concrete surfaces.

B. Metal forms: Treat surfaces as recommended by manufacturer before placing reinforcing.

C. Secure to formwork.

SECTION 03100
CONCRETE FORMWORK

PART 3 EXECUTION

3.01 INSPECTION

A. Verify accurate conformance to required lines, levels, and measurements.

B. Ensure form ties, wales, bracing, and anchorages are properly placed and constructed.

C. Ensure proper bracing and reinforcement at points of application of construction loads, concrete dump points and temporary non-uniform load applications.

3.02 FORM CONSTRUCTION

A. Forms shall be strong, straight, adequately braced and securely fastened. Fit and secure to preceding work to assure completed surface free from irregularities and offsets.

B. Minimize form joints. Arrange exposed joints symmetrically and match architectural lines. Make joints tight to prevent mortar leakage.

C. Reuse form material only if clean and undamaged.

D. Arrange and assemble formwork to permit dismantling and stripping, so that concrete is not damaged during its removal.

E. Corner treatment:
   1. Form exposed corners to produce smooth, solid, unbroken lines, except as otherwise shown
   2. Provide ¾" chamfer at all exposed external and internal corners and edges, accurately form and surface to produce uniformly straight lines and tight edge joints. Extend terminal edges to required limit and miter chamfer strips at changes in direction.
   3. Concealed corners may be formed square.

F. Set forms and screeds for floors and slabs to provide uniform slope to drains and positive drainage of exterior slabs and steps.

3.03 APPLICATION OF FORM COATING

A. Apply form coating on formwork in accordance with manufacturer's instructions. Apply prior to placing reinforcing steel, anchoring devices, and embedded items.

B. Do not apply form coating where concrete surfaces are scheduled to receive special finishes which may be affected by agent.

C. Forms to be left in-place may be soaked with clean water instead of coating immediately before placing of concrete, except that in cold weather with probable freezing temperatures coating shall be mandatory.

D. Surplus coating on form surfaces and coating on reinforcing steel and construction joints shall be removed prior to placing concrete.

SECTION 03100
CONCRETE FORMWORK

3.04 CLEANING

A. Clean forms to remove foreign matter as erection proceeds.

B. Ensure that water and debris drain to exterior through clean-out ports.

3.05 FORM REMOVAL

A. Minimum time before removal after placing concrete, unless permitted otherwise:
   1. Footings: 24 hours.
   2. Walls, piers, and column: 48 hours (24 hours for metal-lined forms).

B. Reduce removal time by half for high-early-strength cement concrete.

C. In any event, do not remove supporting forms and shoring until concrete has acquired sufficient strength to safely support own weight plus construction loads. Concrete strength shall be demonstrated by job cured concrete specimens provided in addition to those required for concrete control. Remove specimen from molds within 24 hours and provide same cure as in-place concrete. Test one specimen for each 400 sq ft of surface area prior to removal of forms for slabs.

- END OF SECTION -

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SECTION 03200
CONCRETE REINFORCEMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Reinforcing steel for concrete.

B. Supports and ties for reinforcement.

1.02 QUALITY ASSURANCE

A. Perform concrete reinforcement work in accordance with CRSI Manual of Standard Practice, and Documents 63 and 65.

B. Conform to ACI 315.

1.03 SUBMITTALS

A. All materials specified in this Section.

B. Shop Drawings for reinforcing steel.

C. Tests or certificates of compliance for each 25 tons of each bar size of reinforcing steel supplied under each material specified.

D. Mill test reports on reinforcing requiring welding.

E. Shop Drawings will be reviewed by ENGINEER for conformance to reinforcing bar material, size, and spacing only.

PART 2 PRODUCTS

2.01 MATERIALS

A. Bars: ASTM A615 (S1), Grade 60 ksi deformed bars.

B. Welded wire fabric: ASTM A185 plain type; in flat sheets.

2.02 ACCESSORY MATERIALS

A. Tie wire: Minimum 16-gage.

B. Chairs, bolsters, bar supports, spacers: Sized and shaped for strength and support of reinforcement during installation and placement of concrete.

2.03 FABRICATION

A. Fabricate in accordance with ACI 315, providing concrete cover specified on Drawings.

B. Locate reinforcing splices not indicated on Drawings at points of minimum stress. Indicate location of splices on Shop Drawings.

SECTION 03200
CONCRETE REINFORCEMENT

PART 3 EXECUTION

3.01 INSTALLATION

A. Remove scale, loose flaky rust, dirt, grease, curing compound, and other coatings which would impair bond.

B. Install slab reinforcing bars in correct position by use of preformed bolsters and spacers, except concrete blocks may be used to position bars in concrete placed on soil.

C. Space bars properly and tie securely in position before placing concrete. Tack welding to keep reinforcing in place is not per mitted.

D. Lap wire fabric not less than 6".

- END OF SECTION -

SECTION 03300
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cast-in-place concrete and miscellaneous materials.

B. Grout.

1.02 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 117 and 301.

B. Maintain a copy of ACI 117, 301 and SP-15 on site at all times.

C. Testing Laboratories:

1. CONTRACTOR shall retain services of qualified independent testing laboratory. Responsibility of testing laboratory will include:

a. Obtaining, making and transporting field samples of aggregate, concrete, and grout for testing.

b. Conduct tests on following materials as specified herein.

1) Concrete aggregate tests.

2) Concrete strength tests.

3) Concrete slump tests.

4) Concrete air content tests.

5) Grout strength tests.

6) Unit weight.

7) Temperature.

c. Tests on in-place concrete or concrete cores to verify concrete strength where tests on concrete strength tests indicate insufficient strength. Costs for these tests shall be borne by CONTRACTOR.

d. Provide test reports as specified herein.

D. Testing/Quality Control:

1. Concrete supplier to establish proposed concrete mix proportions on basis of either field experience and/or trial mixtures in accordance with ACI 318, Chapter 4, except specific requirements shall conform to requirement of these specifications. Determine and submit supporting data, standard deviation, trial batch tests, required average strength, proportions, air content, and slump range for each mix.

2. Concrete strength tests:

a. Comply with ASTM C39 for testing and ASTM C31 or C192 for preparation of cylinders.

b. Field strength tests: Sample in accordance with ASTM C172; make and test 4 cylinders from each sample on basis of not less than:

1) One sample from each day's placement for each class of concrete,

2) One sample from each 100 cu yd, or

3) One sample for each 5,000 sq ft of surface area for slabs or walls,

4) For a given class of concrete, if frequency of testing specified above would provide less than 5 samples, sample at least 5 randomly selected batches or each batch if 5 batches or fewer are required.

c. Cylinders shall be laboratory cured. Test 1 laboratory-cured cylinder at 7 days and other 2 at 28 days for average strength. One cylinder shall be kept as a reserve if needed or instructed by ENGINEER to be broken.

d. If tests indicate deficient strength as defined by ACI 318, immediately adjust mix to increase average of subsequent test results and, when directed, carry out drilled core testing, ASTM C42 and/or load tests required to establish that load-carrying capacity of structure is not jeopardized. If concrete fails to meet structural design requirements, promptly remove and replace or reinforce as required to satisfy design requirements. Re-testing and remedial work shall be at no additional cost to OWNER.

3. Aggregate tests:

a. Comply with ASTM C33 Class Designation 4S for grading, deleterious substances, abrasion, potential reactivity, and soundness.

b. Test for each size aggregate prior to commencing concrete placement and as follows:

1) Gradation: Each 200 tons.

2) Deleterious substances abrasion, potential reactivity and soundness: Each change in source from which aggregate is taken.

4. Slump tests:

a. Test on basis specified above for field strength tests; comply with ASTM C172 and C143.

1) Perform additional tests on batches that appear to be outside the acceptable limits as specified herein as requested by the OWNER.

b. If slump does not meet Specifications, promptly remove batch from Work and dispose of off-site at location selected by CONTRACTOR. Do not add water in excess of minimum specified water-cementitious material ratio to batch to achieve desired slump.

5. Air content tests:

a. Sample on basis specified above for field strength tests.

b. Obtain samples from concrete after it has been placed and consolidated.

c. Determine air content by pressure method; comply with ASTM C231.

d. If air content does not meet Specifications, remove deficient concrete from Work.

6. Grout strength tests:

a. Comply with ASTM C39 and C192 for preparation of 2" round specimens.

b. Sample (2 cylinders from each sample) and test on basis of:

1) One sample taken and tested prior to placement for each type and strength of grout. (Not required for prepackaged grouts from manufacturer's plant continuously engaged in packaging grout mixtures.)

2) One sample for each day's placement for each type and strength or for each 3 cu ft of grout placed whichever provides most number of samples.

c. Cylinders shall be laboratory cured.

d. Test 1 cylinder at 4 days and one cylinder at 14 days.

7. When ambient temperature during coldest period of day falls below 40°F, cure 1 additional strength test cylinder on site under same conditions as concrete it represents for elevated slabs and beams. Test cylinder prior to removal of forms, shoring and bracing or loading of concrete.

E. OWNER'S Quality Assurance: CONTRACTOR shall provide facilities and services of one or more employees, as necessary or requested to assist OWNER with their Quality Assurance Program.

1.03 SUBMITTALS

A. All materials specified in this Section.

B. Samples of concrete aggregates for testing by CONTRACTOR'S testing laboratory. CONTRACTOR shall coordinate with testing laboratory to ensure sufficient quantities of material are provided for testing. Coordinate with testing laboratory to allow sufficient time for testing and submittal of test results prior to initial concrete placement.

C. Proposed concrete design mixes with supporting data and test results. Submit minimum of 14 days prior to start of concrete placement.

D. Testing laboratory reports:

1. Submit reports immediately after conducting tests.

2. Test reports shall contain following information:

a. Testing agency.

b. Project identification.

c. Material tested and date of test.

d. Material source or placement description, as applicable.

e. Tests performed and referenced standard.

f. Test results and referenced standard or specification criteria.

3. Bind reports in one volume at end of Project and give 1 copy each to OWNER and ENGINEER.

4. Following reports shall be submitted no later than 14 days prior to start of concrete placement for each class of concrete and aggregate size:

a. Initial concrete fine and coarse aggregate tests.

b. Proposed concrete design mixes and supporting data.

E. Manufacturer's tests or certificates of compliance with specified standards, 14 days prior to commencing concrete placement for cement: From each car from which cement will be used.

F. List of admixtures, sealers, curing agents, surface finish materials, grout and other manufactured materials furnished. Furnish manufacturer's literature and written recommendations for products furnished as equal to that specified or to meet performance requirements.

1.04 STORAGE OF MATERIALS

A. Cement: Keep clean, dry, and free from weather damage.

B. Aggregates: Stockpile each gradation separately on clean, non-contaminating surface.

PART 2 PRODUCTS

2.01 CONCRETE AND GROUT MATERIALS

A. Cement:

1. Portland cement: ASTM C150, Type V.
2. White cement: Non-staining, ASTM C150, Type V.
3. Use only 1 brand of each type of cement.

B. Aggregate:

1. Regular aggregate: Strong, durable, well-graded minerals conforming to ASTM C33 requirements for grading, deleterious substances, abrasion, potential reactivity, and soundness. Sand equivalent shall not be less than 80 per ASTM C778.
2. Aggregates not conforming exactly to above specifications may be used provided:
   a. Special tests or actual service establish that such aggregates will produce concrete of quality specified.
   b. An Addendum to Specifications is issued.
3. Coarse aggregate:
   a. 1-1/2" to No. 4: Use for all concrete unless specified otherwise.
   b. ¾" to No. 4: Use for slabs and thin sections and areas where clear spacing between reinforcing bars is less than 3".

C. Water: Clean, fresh, free from injurious amounts of oil, alkali, acid, salts, organic materials, or other substances that may be deleterious to concrete or steel.

D. Admixtures:

1. Water-reducing and set-controlling admixture, ASTM C494, Type as required. Use for all concrete.

2. Air entraining agent, ASTM C260. Use in accordance with manufacturer's recommendations. Use for all concrete.
3. No Calcium Chloride.
4. No Fly ash or natural pozzolans.

2.02 CONCRETE DESIGN AND USE

A. Each concrete design mix shall be established in strict accordance with ACI 318 by proportioning on basis of field experience or trial mixtures.

B. Strength classifications:

Class	Required Compressive Strength, f'c	Average Compressive Strength
A	4,500 psi	5,200 psi
C	3,500 psi	4,700 psi

C. Average compressive strengths: Produce concrete of average strengths noted above unless test results substantiate a lower permissible average strength based on standard deviation criteria set forth in ACI 318.

D. Concrete use:

1. Class A: Use for all concrete unless specified otherwise.
2. Class C: Use for fill concrete and thrust blocks.

E. Minimum cement content: 6.0 sacks of cement per cubic yard of concrete.

F. Maximum water-cement ratio: 0.40 by weight.

G. Air entrainment: Concrete shall contain entrained air within following limits.

Nominal Maximum Size of Coarse Aggregate, In.	Total Air Content, Percent By Volume
¾"	4 to 8
1-1/2"	3 to 6

H. Workability:

1. Proportions of concrete shall produce a mixture, suited to placement methods, which will work readily into corners and angles of forms and around reinforcement and embedded items. Segregation of materials or free water will not be permitted.
2. Slump of concrete: Use minimum practical; vary within limits given to suit placement conditions; in no case is slump to be increased by addition of water in excess of design mix quantity:

Type of Construction	Slump, in.	
	Minimum	Maximum
All concrete unless noted otherwise	2	5

3. Maximum slumps are without a high range water agent. Maximum slump with a high range water reducing agent shall not exceed 8".

2.03 MEASURING

A. Ingredients:

1. Cement: By weight or bag.
2. Aggregate: By weight.
3. Water: By weight or volume.

B. Equipment: Must provide easy, accurate control, and easy checking.

2.04 MIXING

A. Mixer: Mechanical batch type; minimum capacity, 1/2 cu yd.

B. Minimum time: One minute after all ingredients are in mixer for mixer up to 1 cu yd capacity; increase 15 seconds for each additional 1/2 cu yd capacity. Mix until mass is homogeneous and uniform in color.

C. Mixing equipment shall be clean before using.

2.05 READY-MIX CONCRETE

A. May be used if concrete provided meets requirements of concrete specified and if concrete is furnished by an established, approved plant. Ready-mix plant equipment and plant shall be certified in accordance with NRMCA QC 3.

B. Equipment and methods: ASTM C94.

2.06 EXPANSION JOINT MATERIALS

A. Expansion joint filler: Preformed non-extruding and resilient non-bituminous type, ASTM D1752, Type I.

B. Joint sealant backing rod:

1. Type: "Ethafoam" round, preformed resilient rod by Dow Chemical Co.; "Sonofoam Closed Cell Backer-Rod" round, preformed, closed-cell polyethylene rod by Sonneborn, or equal.
2. Diameter: Manufacturer's recommendations for joint width.

C. Seal joint exposed surface(s) with joint sealant.

SECTION 03300
CAST-IN-PLACE CONCRETE

2.07 JOINT SEALANT

A. Vertical joints: "Sonolastic Two Part" 2-component gun-grade polysulfide base sealant by Sonneborn Division of ChemRex, Inc.

B. Horizontal joints: "Sonolastic SL 2" 2-component polyurethane base by Sonneborn Division of ChemRex, Inc.

1. Provide bond breaker polyethylene tape between sealant and filler where backing rod is not utilized.
2. Provide primer as recommended by manufacturer.
3. Use for expansion joints, isolation joints, sawcut joints, tooled joints, and other locations indicated on Drawings.

2.08 WATERSTOPS

A. Polyvinyl chloride:

1. Conform to COE Spec. CRD-C-572.
2. Manufacturer: Greenstreak, W. R. Meadows, Inc., Vinylex Corp., or equal.

B. Rubber:

1. Conform to COE Spec. CRD-C-513.
2. Manufacturer: Greenstreak; Williams Products, Inc., or equal.

2.09 CURING MATERIALS

A. Liquid membrane-forming compound:

1. ASTM C309, Type 1, VOC compliant with local and state regulations with fugitive dye, except Type 2 with white pigment for surfaces exposed to direct rays of sun.
2. Do not use compounds containing wax, oil, resin, varnish, or other bases that will prevent bonding of finishes such as floor coverings, tile, separate wearing course, additional concrete, paint, and similar applied finishes.
3. Use for curing at CONTRACTOR'S option except where other products are specified for particular application.

B. Plastic film:

1. Polyethylene plastic film, white, non-staining, conforming to ASTM D2103.
2. Minimum 4-mil thickness.
3. Use for curing at CONTRACTOR'S option except where other products are specified for particular application.

C. Absorptive mat:

1. Cotton fabric, burlap fabric, or burlap-polyethylene material woven or bonded to prevent separation.

2. Material shall be clean and non-detrimental to concrete or finish.
3. Use for curing at CONTRACTOR'S option except where other products are specified for particular application.

2.10 GROUT

A. Regular grout (patching mortar):
1. One part portland cement to 3 parts fine aggregate with sufficient water to maintain adequate workability. Substitute white cement for normal portland cement to match color of adjacent concrete.
2. Minimum strength: 4,500 psi at 28 days.
3. Use for repair of concrete and filling tie holes.

B. Finishing grout:
1. Two parts normal portland cement, 1 part white cement, 4-1/2 parts fine aggregate mixed with water to consistency of thick paint. CONTRACTOR may use acrylic additive such as approved Thoroseal or Sika products, or equal.
2. Use for rubbing permanently exposed interior and exterior surfaces of structures.

C. Nonshrink grout:
1. Nonshrink, nonmetallic, and free of chloride, gypsum or corrosive-type materials; ASTM C1107, Grade A; formulation suitable for application.
2. Minimum strength: 6,000 psi at 28 days.
3. Use for grouting beneath baseplates, bearing plates, equipment bases, precast roof planks, and where indicated.

D. One sack slurry mix: Fill pipes and structure as shown on Drawings.

PART 3 EXECUTION

3.01 INSPECTION

A. Verify reinforcement, anchorages, plates, edge materials, inserts, and other items to be cast in concrete are properly placed and secured.

B. Verify openings, recesses, and similar variations to concrete shape are formed and secured.

C. Verify concrete may be placed without resulting in voids and honeycomb areas. Make provisions for release of trapped air.

D. Verify forms are securely braced and tied.

E. Verify elevations and dimensions are accurate.

SECTION 03300
CAST-IN-PLACE CONCRETE

3.02 PREPARATION

A. Remove laitance from previously placed or existing concrete. Thoroughly clean surface and apply bonding agent.

B. Clean reinforcing steel and other embedded items.

C. Provide for transport and placement of materials.

D. Provide for adequate means and equipment to consolidate concrete. Standby vibrators or other consolidation equipment shall be on-site in case of equipment malfunction.

E. Dampen subgrades and forms.

F. Thaw subgrade, forms, and embedded items.

3.03 PLACING CONCRETE

A. Clean transporting equipment, reinforcing, and embedded items before placing concrete. Remove water and debris from places to be occupied by concrete.

B. Place no concrete until forms, reinforcing, and embedded items have been verified as adequately supported, accurately placed and reinforcing steel placement has been checked by OWNER, CITY and CONTRACTOR'S special inspector. Place no concrete over water-covered, muddy, or frozen soil.

C. Immediately prior to placing concrete for walls with heights greater than 4'-0", place minimum 2" depth of cement-sand paste in bottom of wall forms.

D. Where conditions make placement or consolidation difficult or where reinforcement is congested, batches of mortar containing same proportions of cement, sand, and water as used in concrete shall be deposited in forms around congestion immediately prior to concrete placement to avoid segregation induced "honeycomb."

E. Immediately remove concrete where water, soils, or other deleterious substances are permitted to mix with concrete; form or embedded item movement occurs; or inadequate consolidation is obtained.

F. Hot weather concreting:

1. Applies to concrete when:

   a. Combination of air temperature, sunshine, humidity, and wind indicate a rate of evaporation of 0.15 lb/sq ft/hr (1.0 kg/m2/hr) or greater per ACI 305R, without exception.

   b. Concrete temperature requires an increase in water demand beyond maximum water/cementitious materials ratio to provide workability throughout placement and finishing process.

2. Conform to ACI 305 recommendations and requirements.

3. Control concrete temperature at time of placing by cooling of ingredients and/or use of shaved ice. When ambient temperature exceeds 95°F or concrete temperature exceeds 80°F, ice shall be used.
4. Keep subgrade continuously wet for 24 hours prior to concrete placement.
5. Cool concrete handling equipment forms and embedded items to below 90°F using fog spray and shading as required.
6. Provide wind breaks to protect from moisture evaporation, when necessary.
7. Schedule all concrete placements for after dark when ambient temperature exceeds 95°F or concrete temperature exceeds 80°F.

G. Cold weather concreting:

1. Applies to concrete placed and cured when ambient temperature is below 40°F.
2. Conform to ACI 306 recommendations and requirements in addition to requirements of Contract Documents.
3. Thaw aggregate, subgrade, forms, and embedded items to remove frost and obtain temperature above freezing prior to, and maintain above freezing for at least 7 days after, placement of concrete. Metal forms shall be insulated or covered to prevent loss of heat.
4. Maintain minimum concrete temperature of 55°F for 72 hours after placing. Maintain minimum concrete temperature above 32°F for 5 additional days. Use no salt or chemicals to prevent freezing.
5. Control rate of temperature drop when protection is removed.
6. If temporary heating facilities used are of type which produce an atmospheric condition of high carbon dioxide content, seal off concrete in such manner that no damage will result to concrete surface.

H. Employ best industry practices to prevent segregation during placing. Do not drop concrete more than 5'. Use tremied or pumped concrete to provide proper placement. Place in layers approximately 18" deep.

I. Place concrete continuously in each section until completed. Permit not more than 30 minutes between depositing adjacent layers of concrete within each section, unless an acceptable set retarder is used in concrete mix.

J. Thoroughly compact, puddle, and vibrate concrete into corners and around reinforcing and embedded items. Use internal vibration where size of section permits.

K. Maintain concrete temperature between 50°F and 85°F while placing except as specified for hot and cold weather concreting and mass concrete.

L. Place sections of concrete in sequence which eliminates shrinkage effects to greatest extent practicable.

M. If concrete is to be placed by pumping, submit details of placement for review.

N. Immediately following both placement and form removal, thoroughly clean up concrete spatter, leakage, and spills.

O. Paint steel surfaces where existing coatings are damaged by placement and cleanup operations.

P. Saw cut joints shall be cut immediately after concrete has set sufficiently to allow foot and equipment traffic without damaging concrete surface and to allow sawing without damaging concrete. Work shall be executed during non-regular working hours, if required, to comply with above specified timing.

Q. Protect concrete from injury due to sun, cold weather, running water, construction operations, and other causes until properly cured.

3.04 PUMPED CONCRETE

A. Conform to ACI 304 and 304.2 recommendations and requirements.

B. Aluminum materials shall not be used in contact with fresh concrete.

C. Provide design mix specifically suited to pumping.

D. Provide back-up for each component of system.

E. Provide special mix or mortar to lubricate transport line at beginning of each placement.

F. Provide for transport line cooling when ambient temperature exceeds 85°F and heating when ambient temperature is less than 32°F.

3.05 CONSTRUCTION JOINTS

A. Install only where shown or where specifically permitted.

B. CONTRACTOR shall locate joints using following guide for ENGINEER'S review.

C. At other places at least likely to impair strength and appearance.

D. Provide additional shear reinforcement where requested by ENGINEER.

E. Maximum pour unit shall be less than 30' in any dimension unless specified otherwise.

F. Slabs-on-grade: Place concrete in continuous side-by-side strips with at least 48 hours curing time before placing concrete in adjoining units. Small slab areas less than 35' in greatest dimension may be placed in a checkerboard pattern.

G. Keep exposed horizontal construction joints level and straight by attaching wood strip to inside of form. Place concrete to level ½" above bottom of strip. Remove strip within 2 hours after placing concrete and repair irregularities in joint.

SECTION 03300
CAST-IN-PLACE CONCRETE

3.06 EXPANSION AND ISOLATION JOINTS

A. Formed joints: Make exposed edge of concrete slightly rounded with edger at joints to contain joint sealant.

B. Covered joints: Install cover anchorage in form prior to placing concrete, protect joint, and after construction activity which would damage cover are complete, clean out joint and install cover.

C. Install materials in accordance with manufacturers' instructions. Set preformed material securely in place before placing concrete.

D. Install joint filler at correct depth below concrete surface to allow space for backing rod, if required, and sealant at exposed surface. Fill remainder of joint with joint sealant.

3.07 EMBEDDED ITEMS

A. Install items required under this contract to be embedded in concrete. Install items required by others for embedding in concrete, if so instructed before placing concrete.

B. Fasten embedded items securely in proper position before placing concrete.

C. Conduit or pipe embedded in slabs or walls:

1. Material: Uncoated or galvanized steel or iron clean and free from rust; minimum thickness equal to standard weight pipe unless specified otherwise.
2. Size: 1/3 wall or slab thickness maximum outside diameter.
3. Locate in center of slab or wall and space not closer than 3 diameters on center; locate to avoid impairing strength of concrete.
4. Coordinate placing of reinforcing with conduit or pipe location. Do not cut reinforcing to clear conduit or pipe.

3.08 GROUTING

A. Roughen concrete surfaces by light chipping to remove laitance to approximately ¼". Do not expose reinforcing steel.

B. Remove materials which might interfere with bond; prepare surfaces in strict conformance to manufacturer's instructions.

C. To facilitate cleanup, mask adjacent surfaces of equipment and concrete with masking tape or paste wax.

D. Provide formwork as required.

E. Mix, place, and cure grout in strict accordance to manufacturer's instructions.

F. Minimum thickness: 1" unless specified otherwise.

G. Remove shims after grout is placed. Fill shim voids with grout.

SECTION 03300
CAST-IN-PLACE CONCRETE

3.09 FINISHING

A. Flatwork:

1. Tamp concrete to force coarse aggregate down from surface.
2. Screed with straightedge, eliminate high and low places, bring surface to required finish elevations; slope uniformly to drains.
3. Dusting of surface with dry cement or sand during finishing processes is not permitted.
4. Apply hardeners, sealers, nonslip surfacing, and similar materials in accordance with manufacturer's instructions during or after finishing.
5. Finish surfaces within following tolerances in accordance with ACI 117:
   a. Slabs: 3/16" in 10'.
   b. Sidewalk: 5/16" in 10'.
   c. Top surfaces of structures other than slabs: In accordance with ACI 117.
6. Trowel finish:
   a. Float surface to true, even plane.
   b. Steel trowel to smooth, uniform finish, free of defects; steel trowel second time to final burnish finish; use edger on exposed edges.
   c. Use on floors and interior slabs except areas to receive grout, fill concrete or equipment foundations.
7. Float finish:
   a. Float surface to true, even plane.
   b. Float second time to uniform finish with wood or cork float; use edger on exposed edges. Install chamfer edge if requested at no additional cost to OWNER.
   c. Use on exterior slabs, sidewalks, and exposed horizontal surfaces of equipment pads and foundations.
8. Roughened finish:
   a. Float surface to true, even plane.
   b. Roughen surface with rake or stiff broom to minimum depth of ¼".
   c. Use on surfaces receiving fill concrete, grout, or concrete equipment pads.

B. Formed surfaces:

1. Remove fins, projections, and loose material.
2. Clean surfaces of form oil.
3. Patch honeycomb, aggregate pockets, voids, and holes as follows:
   a. Chip out until sound concrete is exposed to minimum depth of 1".
   b. Prepare patching mortar.
   c. Saturate surfaces with water and fill cavities with patching mortar.

4. Fill holes left by form ties with patching mortar.
5. Cure patches as specified for concrete.
6. Grout-cleaned finish:
   a. Apply to surface within 180 hours after placing concrete.
   b. Prepare finishing grout.
   c. Wet surfaces and rub grout on surfaces using rubber or cork float so that small voids and imperfections are filled.
   d. Allow surfaces to dry for approximately 1 hour, scrape off excess grout with trowel; rub surfaces with burlap sacks.
   e. Keep surfaces continuously damp for 24 hours.

C. Exposed surfaces:
   1. All interior and exterior exposed surfaces shall be given on acrylic rub.
   2. Manufacturer: Thoroseal, or equal.

3.10 CURING

A. Cure concrete; begin curing as soon as possible after placement of concrete.

B. Use of liquid membrane-forming curing compound permitted for all concrete except where product would impair bond of other applied materials to surface.

C. Plastic film curing:
   1. Dampen surface of concrete and lay plastic film with minimum 6" side laps; tape side laps.
   2. Hold film in place with lumber or use similar provisions to prevent exposure of concrete for 7 days after placing.

D. Water curing:
   1. Keep concrete continuously wet for 7 days after placing.
   2. Use on concrete surfaces not receiving compound or plastic film curing.
   3. Clean, non-staining absorptive mat may be used with water curing.

E. Cure grout and miscellaneous cementitious placements by one of specified methods.

- END OF SECTION -

SECTION 03401
PRECAST MANHOLES

PART 1 GENERAL

1.01 DESCRIPTION

A. Provide and construct manholes and vaults as indicated and specified.

1. Base: Precast or Cast-in-Place concrete. Tops accurately shaped by ring forms to suit riser sections.
2. Walls (Risers and Cones): Precast Concrete
3. Top of Cone: Reinforced concrete grading rings for adjusting frame to match finished surface (not to exceed 11 in.).
4. Frames and Covers: Cast-iron

1.02 RELATED WORK

A. Related work specified in other sections:

1. Division 1: General Requirements
2. Section 02200: Earthwork
3. Section 03200: Reinforcement Steel
4. Section 03300: Cast-in Place Concrete

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM) Publications:

1. ASTM A48: Specification for Gray Iron Casting.
2. ASTM C150: Specification for Portland Cement.
3. ASTM C207: Specification for Hydrated Lime for Masonry Purposes.
4. ASTM C478: Specification for Precast Reinforced Concrete Manhole Sections.
5. ASTM C913: Specification for Precast Water and Wastewater Structures.
6. ASTM C923: Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures and pipes.
7. ASTM D4101: Specification for Propylene Plastic Injection and Extrusion Materials.
8. AASHTO M198: Joints for Circular Concrete Sewer and Culvert Pipe

1.04 SUBMITTALS

A. Shop Drawings: Submit the following in accordance with Section 01300 - Submittals:

1. Submit manufacturer's specifications and product data. Provide proposed details and design calculations for stresses in critical section of vaults and risers for loading conditions including live loads, backfill loads, handling, and transportation. Calculation to be stamped by and Engineer registered in Nevada.

2. Submit manufacturer's written instruction for installing resilient connector.

PART 2 PRODUCTS

2.01 MATERIALS

A. Portland Cement: ASTM C150, Type V.

B. Hydrated Lime: ASTM C207, Type S.

C. Sand: Fine Aggregate, for mortar, Section 03300.

D. Frames and Covers: Cast Iron minimum Class 25 conforming to ASTM A48, and as follows:

1. Castings to be free from scale, lumps, blisters and sandholes.
2. Machine contact surfaces to prevent rocking.
3. Thoroughly clean and hammer inspect.
4. Capable of withstanding AASHTO H-20 loading unless otherwise indicated or specified.

2.02 PRECAST CONCRETE SECTIONS

A. ASTM C478 and ASTM C913 with the following modifications:

1. Cement: ASTM C150, Type V, or as directed by ENGINEER.
2. Joints between sections: Butyl rubber-based sealants.
3. Cure by subjecting to saturated steam at temperature between 100 and 130 degrees F. for 12 hours or more.
4. Cast or drill only two lift holes in each section.
5. Clearly mark date of manufacture and name or trademark of manufacturer on insides of walls on all sections.
6. Accept on basis of material tests and product inspection.

B. Cones and Conical Transitions similar in design and construction to riser sections. Use flat slab tops only where indicated.

C. Cast and build into bases during manufacture:

1. Resilient connectors for pipe connections
2. Holes for future pipe connections

2.03 JOINTS

A. Between precast sections: Butyl rubber-based sealants per Type B, AASHTO M198, but no bitumen content.

B. Resilient connectors for pipes to precast sections: ASTM C923, and to manufacturer's standards. Do not use connectors using castings and bolts with non-resilient bearing.

C. Rubber ring waterstops for use in pipe-to-manhole joints: Rings of resilient material that will fit snugly over pipes, held firmly against pipe surface by means of a mechanical take-up device which when tightened will compress resilient material or by a stretch fit. Waterstop designed and installed so that leakage between pipe and manhole is minimized. Materials and manufacture of waterstops: ASTM C923.

D. Non-shrink mortar for pipe connections to existing manholes:

1. Masterflow 713 Grout made by Master Builders, Cleveland, OH.
2. Five Star Grout made by U.S. Grout Corp., Old Greenwich, CT.
3. Upcon made by Upco Co., Cleveland, OH.
4. Or acceptable equivalent product.

2.04 MIXES

A. Concrete: Cast-in-place, as specified in Section 03300

B. Mortar: For Plugging lift holes: Mix Portland cement and sand in proportion by volume of 1:1-1/2, with sufficient water.

PART 3 EXECUTION

3.01 SETTING PRECAST SECTIONS

A. Set verticals with sections and steps in alignment. Set bases true to line and elevation.

B. Install Butyl rubber-based sealants in joints between sections.

C. Plug holes for handling with mortar. Hammer mortar into hole until dense and excess of paste appears, then smooth flush with adjoining surface.

D. Cast in place bases shall have a preformed groove to receive precast section.

E. Field cutting will not be allowed without prior approval of the ENGINEER.

3.02 JOINTING AND CONNECTIONS

A. Joints between precast sections, and between pipes and precast sections conforming to related standards and manufacturer's instruction.

B. Hold rubber ring water stops for pipe-to-manhole firmly against pipe surface by mechanical take-up device to compress resilient material when tightened. Install to minimize leakage.

C. Apply non-shrink mortar according to manufacturer's instruction.

D. All joints and connections shall be watertight.

SECTION 03401
PRECAST MANHOLES

3.03 SETTING FRAMES AND COVERS

A. Set frames with top conforming to finished ground or pavement surface as indicated.

B. Set circular frames concentric with top of masonry.

C. Set frames in full bed of mortar to fill and make watertight the space between masonry top and bottom flange of frame.

D. Place concrete collar around frame.

E. Place covers in frames on completion of work.

- END OF SECTION -

SECTION 05590
MISCELLANEOUS METALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Secondary aluminum and steel.

B. Anchor bolts.

C. Masonry Anchors.

D. Anchor rods.

E. Grating

1.02 QUALITY ASSURANCE

A. Perform steel welding in accordance with AWS D1.1 "Structural Welding Code."

1.03 SUBMITTALS

A. Shop Drawings for miscellaneous steel and aluminum.

B. List of manufactured materials proposed, identifying manufacturer and type.

PART 2 PRODUCTS

2.01 MATERIALS

A. Secondary steel plates and shapes: ASTM A36. Weld in conformance to requirements of AWS D1.1.

B. Secondary aluminum plates and shapes: Type 6061-T6, ASTM B209 or B211.

C. Stainless steel: ASTM A240 Type 304 or Type 316.

D. Galvanizing: ASTM A123.

2.02 ANCHOR BOLTS

A. Material: ASTM A307 or A36.

B. Provide anchor bolt assemblies for:

1. Structural steel furnished under this Section.
2. Equipment and structures furnished by others, where detailed on Drawings.

C. Provide washers and heavy hexagon heads and nuts on anchor bolts unless specified otherwise.

D. Do not prime paint surfaces which are to be embedded in concrete.

E. Provide double nuts for anchor bolts used for installation of machines and other equipment subject to vibration.

2.03 MASONRY ANCHORS

A. Type: Solid-core masonry anchors (anchored in grout-filled or solid masonry) unless specifically noted on Drawings as "Hollow Masonry Anchors."

1. Manufacturer: "HY-150 Adhesive System" by Hilti; "Epcon Ceramic 6 Epoxy Anchoring System" by ITW Ramset/Red Head; or equal.

2. Fill hollow core masonry cells with grout where anchors will be installed.

B. Hollow masonry anchors:

1. Manufacturer: "HY-20 Adhesive System" by Hilti; "Epcon Ceramic 6 Epoxy Anchoring System" by ITW Ramset/Red Head, with screen; or equal.

2. Use for anchoring lightweight equipment resulting in anchor loads below manufacturer's allowable loads or where specifically identified for use on Drawings.

C. Masonry anchor rods:

1. All-threaded.

2. Standard rod: ASTM A36.

3. Stainless steel rod: Threaded ASTM F593 (AISI 304).

2.04 ANCHOR RODS

A. Type:

1. All-threaded.

2. Standard (unless indicated otherwise on Drawings): ASTM A36.

3. High-strength: ASTM A193, Grade B7.

4. Stainless steel: ASTM F593 (AISI 304).

B. Anchor rods in concrete with 2-component blend of resin and hardener. Filler material may be mixed with resin and hardener in accordance with manufacturer's directions.

C. Manufacturer:

1. Vertical anchor rods installed in concrete from below: "HEA Adhesive" by Hilti, or equal.

2. Horizontal anchor rods and vertical anchor rods installed in concrete from above: "HY-150 Adhesive System" by Hilti; "Epcon System" by ITW Ramset/Red Head; or equal.

2.05 STEEL GRATING

A. Use welded rectangular grating conforming to standards of NAAMM.

B. Size of bearing bars: 1-1/4" x 3/16" (32 mm x 4.8 mm) at 1-3/16" (30 mm) oc, unless shown otherwise.

C. Make sections removable; limit weight of each section to not more than 150 lb (68 kg).

D. Grating, plates welded to grating, and grating saddle clips shall be galvanized.

PART 3 EXECUTION

3.01 ERECTION

A. Anchor miscellaneous items securely to concrete or masonry.

B. Install expansion anchors in accordance with manufacturer's recommendations.

3.02 ANCHOR RODS AND MASONRY ANCHORS

A. Install in strict accordance with manufacturer's directions.

B. Perform work using manufacturer's standard equipment including adhesive cartridges, dispensing guns, mixer tubes and extensions, brush, and air nozzle for compressed air cleaning of holes. CONTRACTOR shall possess equipment at site prior to start of installation and workers shall demonstrate knowledge of procedure for installing anchors prior to installation.

C. Where holes are within 6" of edge of concrete, core drill holes.

D. Inspect existing concrete at anchor rod locations for soundness. Report evidence of deteriorated or weak concrete detected from drilling operation or from inspection.

3.03 ANCHOR BOLTS

A. Install embedded anchor bolts as shown on Drawings.

B. Coat threaded portion of anchor bolts with oil or grease and wrap with protective tape at time bolts are positioned for new construction. Tape to remain in place until bolts are secured.

- END OF SECTION -

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SECTION 07900
JOINT SEALERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sealants.

B. Joint cleaner, primers and sealers.

C. Sealant joint backing materials and accessories.

1.02 RELATED SECTIONS

A. Section 04200 - Masonry Units.

1.03 SUBMITTALS

A. Submit manufacturer's product data and installation instructions for each type of joint sealer and accessory material required.

B. Samples of sealant colors.

1.04 QUALITY ASSURANCE

A. Provide each type of joint sealer required produced by one manufacturer.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in manufacturer's original, unopened, undamaged and labeled containers.

B. Store, handle and protect materials from damage or contamination from foreign materials in accordance with manufacturer's recommendations.

1.06 PROJECT CONDITIONS

A. Apply joint sealants as late as possible in construction, preceding application of painting and following cleaning operations. Do not apply joint sealants during inclement weather conditions or when temperature is above or below manufacturer's limitations for installation.

1.07 WARRANTY

A. CONTRACTOR and joint sealant applicator shall jointly warranty elastomeric joint sealants work for 2 years from date of final acceptance. Warranty shall include replacing joints which fail to perform as airtight; or fail in adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration, and stain resistance or general durability.

SECTION 07900
JOINT SEALERS

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Bostic Construction Products Div.

B. Pecora Corp.

C. Sonneborn Building Products

D. Tremco, Inc.

2.02 SEALANTS

A. Type: Polyurethane, single-component; "Dynatrol I."

B. Color: To be selected by ENGINEER from manufacturer's standard colors after award of contract.

C. Use: Sealant work unless specified otherwise.

2.03 JOINT CLEANER AND PRIMER

A. Provide type of cleaning compound recommended by sealant manufacturer for joint surface to be cleaned.

B. Joint primer: Type recommended by sealant manufacturer; compatible with sealant and sealant backing.

2.04 SEALANT BACKING MATERIAL

A. As recommended by sealant manufacturer; nonbonding to sealant and adjacent surfaces.

B. Non-staining and fully compatible with sealant material.

C. Size: To fit joint width in compression, as recommended by backing manufacturer.

D. Where joint design or depth will not permit use of backer rod, provide adhesive backed polyethylene bond breaker tape.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install joint sealer materials and accessories in strict accordance with manufacturer's installation instructions.

B. Install sealant backer rod, except where recommended to be omitted by sealant manufacturer for application indicated. Use rod diameter that will cause compression when installed.

C. Apply sealer materials using handguns or pressure equipment with proper nozzle size. Apply joint sealants in uniform, continuous ribbons without gaps or air pockets, with complete "wetting" of joint bond surfaces on both sides. Fill sealant rabbet to slightly concave surface, slightly below adjoining surfaces. At horizontal joints between horizontal surface and vertical surface, fill joint to form slight cove, so joint will not trap moisture and dirt. Hand tool and finish all joints.

D. Install joint sealants within recommended temperature ranges and to depths indicated or when not indicated, as recommended by sealant manufacturer.

E. Protect adjacent surfaces from damage. Clean soiled surfaces immediately. Replace damaged material which cannot be properly cleaned with new materials.

3.02 SCHEDULE

A. Calk exterior and interior joints around doorframes and other openings in exterior walls.

B. Calk non-movement general interior joints.

C. Install sealants at other locations shown, with sealant appropriate for application.

- END OF SECTION -

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SECTION 09900
PAINTS AND COATINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Protective coating for welded steel reservoirs for all interior surfaces including, but not limited to shell, roof framing, roof plates, columns, floor, piping, manways, and ladders; and painting of all exterior surfaces including, but not limited to, shell, roof, manways, ladders (including cage and door), hatches, vents, and exposed piping.

B. Other on-site surface preparation and painting.

1.02 SUBMITTALS

A. Schedule of products proposed for each system.

B. Product data sheets and material safety data sheets for all paint materials specified.

C. Color charts for all finish paint materials.

D. Method to be used and size and type of abrasive media to be used for abrasive blast cleaning for welded steel reservoirs.

E. Manufacturer's certification of applicator.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Deliver paint materials in sealed original labeled containers, bearing manufacturer's name, type of paint, brand name, color designation and instructions for mixing and/or reducing.

B. Provide adequate storage facilities. Store paint materials at minimum ambient temperature of 50°F in well ventilated, dry and shaded area or per manufacturer's recommended temperature.

C. Take precautionary measures to prevent fire hazards and spontaneous combustion.

1.04 ENVIRONMENTAL REQUIREMENTS

A. Ensure surface temperatures and surrounding air temperature is above 50°F and below 110°F before applying finishes. If surface and surrounding air temperatures are beyond these limits, CONTRACTOR shall provide equipment to maintain manufacturer's temperature limits during coating application. Coating in temperatures beyond these limits must be approved in writing by the material manufacturer.

B. Do not paint while surfaces are damp or during rainy or frosty weather.

C. Do not exterior spray paint while wind velocity is above 13 mph (20 km/h).

D. Provide adequate continuous ventilation and sufficient heating facilities to maintain temperatures above 60°F for 24 hours before, during and 48 hours after application of finishes.

E. Provide adequate lighting on surfaces to be finished.

1.05 HEALTH AND SAFETY REQUIREMENTS

A. Work shall comply with applicable federal, state, and local laws and regulations including analyses of potential impact of painting operations on painting personnel and on others involved in and adjacent to work zone.

B. Worker exposures: Exposure of workers to chemical substances shall not exceed limits as established by American Conference of Governmental Industrial Hygienists: Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices, ACGIH-02 or as required by a more stringent applicable regulation.

C. Toxic compounds: Toxic compounds having ineffective physiological properties, such as odor or irritation levels, shall not be used unless approved by OWNER.

D. Training: Workers having access to an affected work area shall be informed of contents of manufacturer's current printed product description, Material Safety Data Sheets (MSDS) and technical data sheets for each coating system and shall be informed of potential health and safety hazard and protective controls associated with materials used on project. An affected work area is one which may receive mists and odors from painting operations. Workers involved in preparation, painting and clean up shall be trained in safe handling and application, and exposure limit, for each material which worker will use in project. Personnel having a need to use respirators and masks shall be instructed in use and maintenance of such equipment.

E. Provide paints for interior use that contain no mercurial mildewcide or insecticide and that is NSF/ANSI 61 certified for interior coatings.

F. Provide documentation stating that paints proposed for use meet Volatile Organic Compound (VOC) regulations of local air pollution control districts having jurisdiction over geographical area in which Project is located.

1.06 QUALITY ASSURANCE

A. Manufacture's certification of applicator: Manufacturer shall certify that applicator is trained and qualified to apply manufacture's products for this project and has at least 5 years experience applying specified products.

B. Surface Preparation: Surface preparation will be based upon comparison with "Visual Standard for Abrasive Blast Cleaned Steel," SSPC VIS 1-89.

C. Apply paint when the steel temperature or surrounding air temperature is at least 5° F above the dew point, or as recommended by the manufacturer.

D. No coating or paint shall be applied to wet or damp surfaces, in rain, snow, fog, or mist. If such conditions are prevalent, coating or painting shall be delayed or postponed until conditions are favorable. The day's coating or painting shall be completed in time to permit film sufficient drying time prior to damage by atmospheric conditions.

E. Thickness and holiday checking: Thickness of coatings and paint shall be checked with a nondestructive, magnetic type thickness gage. Coating integrity of all interior coated surfaces shall be tested with an approved holiday detection device. Nondestructive holiday detectors shall not exceed 100 volts nor shall destructive holiday detectors exceed voltage recommended by manufacturer of coating system. For thicknesses between 10 and 20 mils (0.25 mm and 0.50 mm) a non-sudsing type wetting agent such as Kodak PhotoFlo 200, shall be added to water prior to wetting detector sponge. All pinholes shall be marked, repaired in accordance with manufacturer's printed recommendations and re tested. No pinholes or other irregularities will be permitted in final coating. Holiday detection devices shall be operated in presence of a representative of OWNER or municipal agency. In cases of dispute concerning film thickness, measurements made with instruments shown to be in calibration with National Bureau of Standards calibration plates shall predominate.

F. Inspection devices: Until final acceptance of coating and painting, CONTRACTOR shall furnish and make available inspection devices in good working condition for detection of holidays and measurement of dry film thickness of coating and paint. Furnish U.S. Department of Commerce, National Bureau of Standards certified thickness calibration plates to test accuracy of dry film thickness gage. Inspection devices shall be in good working order.

G. Acceptable devices: Acceptable devices include, but are not limited to, K D "Bird Dog" nondestructive holiday detector and Tinker Rasor Model M 1 for coating to 20 mils (0.50 mm) dry film thickness; Tinker Rasor Model AP and AP W holiday detectors for coatings in excess of 20 mils (0.50 mm) dry film thickness; and "Inspector" units, or equal, for dry film thickness gauging. Inspection devices shall be operated in accordance with manufacturer's instructions.

H. Warranty Inspection: A warranty inspection in accordance with Section 3.11 shall be conducted by the CONTRACTOR in conjunction with the OWNER during the 11th month following completion or placement into service of all coating and painting work required by this section. CONTRACTOR shall make all arrangements. All defective work shall be repaired in accordance with the manufacturer's recommendation and the satisfaction of the OWNER in order to bring the defective areas up to the quality level of the original work required by this specification.

I. Coating manufacturer's representative shall be present at the site as follows:

1. On the first day of application of any coating on the tank.
2. A minimum of 4 additional site inspection visits, each for a minimum of 4 hours.
3. To resolve field problems attributable to manufacture's product.
4. To verify full cure prior to placing coated surfaces in immersion service.
5. As required to provide manufacturer's certification of proper installation.

J. An independent 3rd party NACE Level 3 Paint Inspector will be provided by contractor prior to final acceptance.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Carboline Coatings Company, St. Louis, MO.

B. ICI Devoe, Louisville, KY.

C. Raven Lining Systems, Tulsa, OK.

D. Sherwin Williams, Cleveland, OH.

E. NSP Specialty Products, Pinehurst, NC.

F. Tnemec Coatings, Kansas City, MO.

G. Madison Chemical Industries, Inc., Rancho Santa Margarita, CA.

2.02 COATING MATERIALS

A. Quality: Manufacturer's highest quality products and suitable for intended use.

B. Materials Including Primer and Finish Coat: Product by same paint manufacturer.

C. Thinners, Cleaners, Driers and Other Additives: As recommended by paint manufacturer of the particular coating.

D. Epoxy Primer: Polyamide or polyamine, anticorrosive converted epoxy primer containing rust inhibitive pigments.

E. NSF Epoxy (AWWA D102-03 I.C.S. 1): Self-priming epoxy coatings intended for potable water contact and certified to conform to NSF Standard 61.

F. Intermediate Epoxy: Two-component epoxy capable of 4 to 6 MDFT per coat, as recommended by the coating system manufacturer.

G. Polyurethane Enamel: Two-component, aliphatic or acrylic based polyurethane; semi-gloss finish.

H. NSF Polyurethane: Plural-component, self-priming polyurethane lining, intended for potable water contact and certified to conform to NSF Standard 61. Use 100% solids, zero VOC, polyurethane formulations such as Polibrid 705 (Elastomeric) as manufactured by Carboline Company; Corrocate II by Madison Chemical Industries (non-elastomeric); or approved equal.

I. Caulking: As recommended by the coating manufacturer for the service condition.

2.03 COLORS

A. Formulate with colorants free of lead and lead compounds.

B. Exterior tank color to be determined during shop drawing phase of project and approved by the OWNER.

C. Proprietary identification of colors is for identification only; selected manufacturer may supply matches.